ROADS AND STREETS

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Concreting Equipment in Operation, Retaining Wall Along Laguna Honda Blvd.; Well Rig and Clamshell in the Distance

Shoring of Steep Sandhill Presents Problem in San Francisco Boulevard Construction

Well Rig and Timber Bulkhead Solve Problem of Protecting Sandy Slope While Retaining Walls Along Laguna Honda Blvd. Are Poured—Scheme Requiring Extreme Care Executed Economically and Effectively

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THE construction of Laguna Honda Blvd. has removed one more of the many barriers encountered in the construction of San Francisco's boulevard system. The topography within the limits of San Francisco has presented many difficulties and has retarded the development of boulevards connecting the various residential districts situated on hillsides and in valleys within the city itself. These problems were attacked and solved in a very economical and effective manner by M. M. O'Shaughnessy, city engineer. This article describes briefly construction problems and methods on a small link in this boulevard system.

Laguna Honda Blvd. provides a level-grade highway between the easterly Sunset district and the new residential district lying west of Twin Peaks. The construction of the Twin Peaks tunnel, a 2¼-mile bore for street-car traffic only, has made this beautiful residential section possible and the last remaining need was the completion of highways for varied types of vehicular traffic.

That part of Laguna Honda Blvd. described in this article is 3,500 ft. long and from 44 to 50 ft. in width from curb to curb; 1,200 lin. ft. of this is bordered by massive retaining walls. These walls protect a roadway 46 ft. wide, including a 6-ft. sidewalk which is 15 ft. above Laguna Honda reser-

voir, lying on the east. On the west, a sand hillside slopes upward from the reservoir on a 1½:1 slope to a height of 150 ft., terminating at the rear of costly homes and apartments.

The construction of the roadway required the removal of a considerable slice from the toe of this westerly slope, even though the roadway surface had been raised 15 ft. above the lake. The entire westerly slope was clean, dry sand, that might be expected to slide and drift or wash under slight rains. The surface of the slope was protected by a natural growth of brush and grass. The problem of removing the sand from the toe of this slope to a maximum cut of 30 ft. will be chiefly described in this article.

The easterly wall, at the edge of the reservoir, is a T-type, reinforced-concrete structure and is adjacent to the reservoir, the side slope of which reaches a depth of 35 ft. within 70 ft. of the easterly wall. When the easterly wall was completed a light cut was made along the toe of the westerly slope and the material deposited against the easterly wall and surfaced with rock, thus providing a service roadway during construction. A narrow bench was then excavated along the westerly slope—about 4 ft. west of the wall location—on which a specially designed well-boring rig was placed. Surveys were made, giving points at correct centers for posts, which—when in position—constituted the first step in a bulkhead construction to retain the westerly slope. The accompanying illustrations will assist in understanding the method of carrying out this work.

Holes were bored in the sand into which timbers of the proper size were placed, plumbed and tamped. Slight wetting was necessary to dampen and compact the sand while boring the hole and a surface shield or casing was used for the top 4 ft. on every hole to prevent surface caving around the rim. Casings were driven for the entire depth in deeper holes and pulled after placing the posts.

The boring equipment was operated by three men. It was moved on skids by its own power, and the outer pulley at the end of the crown block carried a cable by which the casings were handled and posts raised and lowered into the holes. On an average, six posts per day were placed, though with longer sizes (37 to 40 ft.) only three posts per day were set. The post centers and sizes were governed by the bulkhead height.

After the posts were in position, a crew started excavating and placing horizontal lagging, which was cut to lap one-half of the post width at each post. The lagging was placed from the top downward and each lagging section was sprung, tamped behind and wedged at the post.

A Marion revolving steam shovel equipped with boom and clamshell bucket followed the lagging crew, excavating to a new slope of 1½:1, leaving the top of the new slope at the last lagging placed. The shovel was followed by a crew placing the main braces, which were firmly fitted and wedged into the proper inclined position. The braces formed the main support against the hillside and the horizontal lagging was then carried down to subgrade. A close inspection was maintained to see that all lagging was properly placed, sprung and tamped, that all braces were properly wedged and that their kick blocks were properly placed at right angles to the main braces. All main braces were placed on an incline less than the natural slope of the hill above them. This procedure was carried on up to a bulkhead height of 30 ft. without any indication of movement of the slopes being supported.

The concrete retaining wall was now formed and poured. Concrete was mixed in a standard street-paving mixer served by compartment trucks. All aggregate was proportioned by weight, and cement and water were added on the job. The concrete was designed for 3,000 lb. per square inch in 28 days, governed by the water-cement ratio. Actually, a concrete which averaged 4,000 lb. per square inch in 28 days was secured. Concrete was conveyed to an elevated hopper by means of a belt conveyor and from there distributed into the forms by buggies.

In fourteen days after pouring, temporary stulls were placed between the wall and bulkhead posts—all forms having been stripped. These stulls were placed at about one-third of the height of the bulkhead, measured from the top, and were about 3½ ft. long, this being the clearance allowed for forming and bracing the wall. Backfill was next placed to the height of the weepholes and a tile drain was placed, after which the backfill was continued to the height of the main braces. All horizontal lagging was removed as the backfill advanced. The main braces were then removed and the bulkhead was now supported partly by backfill and partly by the stulls previously mentioned. The wall at this stage was about 21 days old. All holes provided for main braces through the wall were now concreted and, after being set and stripped, were coated with hot asphalt. The backfill was then completed and all posts were removed from the ground. No difficulty was encountered in pulling the posts and the work was

Left—Well Rig and 3-Man Crew; 12x14-In. Timber 25 Ft. Long About to Be Lowered Into Hole. Sandy Formation of Slope Can Be Seen Here. Center—Close-Up of Well Rig, Showing Hinged Bucket Bit; Post Is 40 Ft. Long. Right—Close-Up of Bulkhead

Left—Portion of Completed Bulkhead About 20 Ft. High, Showing Boxes in Place to Allow Braces to Be Removed After Pouring of Wall. Right —Wall Poured and Stripped

so timed that a minimum amount of timber was necessary.

The above-described work was carried on from both ends toward the middle, thus allowing the shifting of crews and equipment and providing continuous operation. The wall was poured in alternate 30-ft. sections, with neatly-formed keyed Elastite contraction joints, making it possible to terminate the wall procedure at any 30-ft. interval. Bulkhead timbering was re-used and then all salvaged at a good figure.

This work is now completed and the boulevard is in service, provided with a temporary pavement until filled ground is ready to receive a standard pavement of 8 in. of concrete base, a 1½-in. binder course and a 1½-in. asphaltic concrete wearing surface.

The entire improvement included 2,000 lin. ft. of reinforced concrete sewer, 3 ft. 6 in. wide and 5 ft. 3 in. high, of an egg-shaped section. The work comprised 9,000 cu. yd. of cut, 24,000 cu. yd. of fill, 5,100 cu. yd. of concrete and 430,000 lb. of reinforcing steel.

The roadway traverses a natural pass of unusual beauty.

J. P. Holland was the general contractor and Meyer Bros. were the subcontractors on concrete and bulkhead operations. The completed improvements represents an investment of $250,000. All work was directed by M. M. O'Shaughnessy, city engineer.

Motor Vehicle Taxes.—The following figures taken from a paper prepared by Sir Henry Marberry of the English Road Board for the British Association show the taxes paid in various countries on motor vehicles:

Country	Annual tax on 4-ton truck £*	Annual tax on 32-seat bus £*	Annual tax on 20 hp. private car £*
United Kingdom	104.0	122.0	31.3
Germany	39.6	42.7	41.1
Ohio	33.9	59.7	2.9
Pennsylvania	32.9	31.3	4.8
California	19.3	4¼ per cent of receipts	2.7
Belgium	16.0	16.9	6.9
France	11.2	11.9	6.7
Italy	11.0	8.6	7.8
New York	8.2	14.7	4.3

*£=$4.86.

Through Streets Aim of Traffic Legislation

Emphasizing the growing belief that the establishment of "through streets" will go far toward doing away with traffic ills, eleven state legislatures passed laws designating certain roads as through highways during their sessions, according to "Public Safety." These laws, in nearly every instance, corresponded with Section 22, part (d) of the Uniform Vehicle Code, which reads as follows:

Section 22. VEHICLES MUST STOP AT CERTAIN THROUGH HIGHWAYS. "The (State Highway Commission) with reference to state highways and local authorities with reference to highways under their jurisdictions are hereby authorized to designate main traveled or through highways by erecting at the entrances thereto from intersecting highways signs notifying drivers of vehicles to come to a full stop before entering or crossing such designated highway, and whenever any such signs have been so erected it shall be unlawful for the driver of any vehicle to fail to stop in obedience thereto. All such signs shall be illuminated at night or so placed as to be illuminated by the headlights of an approaching vehicle or by street lights."

Alabama, Delaware, Louisiana, New Mexico, South Dakota and Tennessee adopted this section as it is written. South Dakota, out of this group, is the only state having had an earlier law. This law authorized the State Highway Commission and Board of County Commissioners "to designate certain state and county highways, or portions thereof, as preferential or arterial highways."

The new Connecticut law specifies the Uniform Code provisions, but applies them only to streets within municipalities and under the supervision of local authorities.

Texas enacted the Uniform Code provisions, but omitted all reference to local authorities, leaving the matter entirely in the hands of the state. Neither was there any provision for the illumination of signs at night. Maryland passed Section 22 of the Uniform Code, adding the provisions that the State Road Commission is not only authorized, but directed to designate through highways. In addition, drivers on intersecting roads must yield the right-of-way to vehicles approaching on through highways. In another section the new Maryland law requires vehicles on unpaved roads to stop before entering paved roads and yield the right-of-way to all vehicles approaching on the paved roads. Pennsylvania also gives the right of way to vehicles on the through highway.

Michigan, which had previously passed the Uniform Code provisions, added a section modifying the law to require that before entering or crossing a through highway motor vehicles must, if outside town, slow down to 10 miles per hour and must stop if vehicles are approaching on the highway; if inside city or town limits, they must stop at through streets that have been marked by local authorities.

California enacted the equivalent of the Uniform Code provisions with regard to local authorities, and specified that all highways under the jurisdiction of the Department of Public Works shall be through highways.

International Exhibition of Municipal Public Works in the Netherlands.—From March 11 to 20, 1930, an International Exhibition of Municipal Public Works will be held at Utrecht during the Annual Spring Netherland Industrial Fair. This exhibition is sponsored by the Netherland Society of the Chiefs of Municipal Public Works, the secretary of which is P. Mauta, 164 Joh. Verhulststraat, Amsterdam, Z. The burgomasters and aldermen of several large cities are members of the honorary commitee which has been formed. The exhibition will show plans, drawings, designs, photographs and models of public works executed or to be executed in Netherland, East India, and foreign cities, among which will be road construction and parks. Private firms, manufacturers and dealers, will exhibit various kinds of building and road building materials. Americans desirous of making lectures or sending in exhibits should send in their requests as detailed as possible to the address of the society given above.

Construction and Maintenance of Low-Cost Roads

An Outline of the Important Facts Regarding the Maintenance of Untreated Surfaces of Stone, Gravel, Slag, Marl and Other Local Materials

FINE crushed rock and gravel roads have been built extensively since the war in all parts of the country, particularly in the west and middlewest. They differ from the water-bound macadam formerly in vogue not only in the smaller size of aggregate use, but in the variety of materials utilized, and to secure a compact thickness of road metal, the use of the drag or grader under traffic rather than a road roller. Under constant and intelligent maintenance these roads present a much smoother surface than was formerly the case.

Size of Material.—The term traffic bound roads is most often used to designate such surfaces. A maximum size of 1½ in. is generally used for first course and material passing a 1-in. or ¾-in. opening for the top. The method of building generally used is to spread from trucks on the prepared grade, spread with a blade grader leaving not over 2 in. of loose material on the traveled way, and the surplus in windrows along the sides. These piles along the sides form a storage which is gradually dragged in as traffic compacts the thin layers. Thus a dense compact surface is secured from the very bottom up.

Amount of Material.—For first coat work 1,000 to 1,500 cu. yd. of material per mile is spread and windrowed, depending on the character of the material in the subgrade and the width of surface desired. Ofttimes the amount of money available controls the quantity of material used. It is a general practice to place stock piles for use in mending weak places that may develop. In recovering, 300 to 600 cu. yd., part going to stock piles, is used per mile.

On gravel and stone surfaces a mulch of ½-in. loose material on the compacted surface is necessary to keep maximum smoothness.

Flat Crown Best.—A flat crown of ¼ to ⅜ in. per foot will greatly assist during dry weather. This with frequent dragging presents a surface that the motor vehicle driver will not drive into tracks. Traffic will use the whole surface because it is uniform and there is no reason to ride in the center, as in the case of high crowns.

During wet weather it may be necessary to increase the crown to avoid water pockets, which under traffic soon turn to pot holes.

Replacement.—The costly part of the maintenance of untreated surfaces is the replacement of aggregates blown off the road. When traffic increases much over 400 vehicles per day, or when local supplies become exhausted, this item may run so high as to make it advisable to use some sort of a treated surface. It is variously estimated that 1 in. of material is lost per year for each 200 to 400 average daily motor vehicles, depending on the climate and the character of the road metal.

The Highway Research Board report for 1928 said that Indiana figures on gravel road "showed that the loss of gravel is 0.289 cu. yd. per mile per year per average daily vehicle. This is not as great an amount as is usually supposed."

Quality of Material.—Hard crushed aggregate gives best results. Lime rock, caliche, marl and similar soft materials can be made more resistant to traffic by scarifying and working into the surface sand, gravel or hard stone. The high cost of such materials in some localities make it economical to apply a surface treatment.

Maintenance Methods.—As noted above, it is well to have a flat crown, and this can be easily obtained where construction operations are shaped toward that end. In taking over some old road for maintenance, long neglected, it may be necessary to scarify it to remove a high crown, although this should be avoided if possible. It will be found frequently that large size material will thus be brought to the surface and have to be disposed of. Unless the climate is very dry it should be possible to remedy high crowns by building up the edges or to fill pot holes by proper manipulation of materials. Corrugations can be cut by heavy drags.

Blading and Dragging.—It is only where materials are less than 1½ in. in size and preferably not over 1 in. that blading and dragging can be used with good results on untreated surfaces.

The idea is to keep a thin layer of loose material worked back and forth. Excellent results are obtained by the use of both blade graders and heavy road drags. These latter built long and heavy cut down all bumps and produce a remarkably smooth surface.

The amount of blading depends on the volume of traffic and the climate. When it reaches over 200 vehicles per day, the road will likely have to be gone over daily. When traffic reaches around 400 per day it is hard to keep untreated surfaces smooth.

The handiest and best piece of equipment for the maintenance of untreated surfaces is the one-man motor patrol grader.

It is advisable to blade the material in a single windrow alternately from one side of the road to the other when the amount is such that it can be done.

Untreated surfaces are frowned upon as uneconomical, but it would be hard to prove this to those folks who, for years, held prisoners as it were by mud roads, are suddenly given their release by one of these low cost roads. They are used in general where there is no money to pay for anything better.

The question often arises where a county has taken the job of improving some old road just how much expense is justified. First, let us consider the grade. In flat country this presents no problem. In hilly country it may be more costly than surfacing. Large amounts of money can be saved in hilly country over what might be called a "railroad grade." In case it is felt that in time the road may be one of importance and yet small funds are at hand these things can be done. The idea is to have a so-called "stage construction" plan in mind. Costs can be cut by using steeper grades, thus reducing the amount of excavation. It is best to try by all means to stick to the ultimate alignment even at the expense of heavy grades. If then at some future time funds are available for it, regrading can be done without the original investment being a total loss.

A case in mind was where plans had been prepared for a grading and structure job five miles long in hilly country estimated to cost $125,000. A study of the case indicated that the expected future traffic was small and raised the question of the economy of spending $25,000 a mile for a grade only. The plans were ordered revised. With almost the same alignment a change in the grade line and other modifications cut the estimate so that a good grade plus a traffic bound surface was obtained for $85,000. The idea is that a point is reached where added costs do not bring as much added road value.

Acknowledgment.—The foregoing is an abstract of a preport of a Sub-Committee on "Untreated Surfaces" (R. C. Hill, chairman), presented at the recent convention of the American Road Builders' Association.

Indiana to Construct 500 Miles of Pavement.—The State Highway Commission of Indiana proposes building 500 miles of pavement in 1930, and to this end 245 miles, and slightly in excess of $1,000,000 worth of bridges, are already contracted. The commission also will cause to be treated with oil and calcium chloride many miles of roads not in this year's paving program.

The Financing of Highways

Present Conditions, Methods of Distribution and Financing, and Comparison of Present Use of Construction and Maintenance Funds

The financing of highways resolves itself into two principal factors, first, sources of income and, second, distribution. State highway systems have benefited most by income received from expanding motor vehicle taxes and this has been a satisfactory trend. The question of financing now becomes one of distribution between states and the smaller political subdivisions. This is being accomplished in many states to some extent by various methods. Sharing of gas tax with counties and cities has become general practice and with the increase in rates continuing, rural roads will secure further benefits from this source. A constructive discussion of this subject is given in the report of the A. R. B. A. General Committee on Highway Finance, which was presented at the recent convention of the American Road Builders Association. The report is reprinted below.

THE shifting of the tax burden from levies on real estate and other sources to the user of the highway is a constructive step in securing funds for highway activity. This change from the use of funds derived from general assessments to the use of funds secured from registration fees and gas tax should continue to a point where general taxation for highway purposes is reduced to a minimum. With a steady increase in revenues derived from automobile taxes assured, and additional funds derived from increased federal appropriations probable, these sources should eventually account for the greater percentage of financing on state and county highways.

The use of county funds for state highway construction is the practice in many states and accounts for a large percentage of the expenditure in these states. The financing of state highways with county funds, however, is not recommended and should diminish with the increase in revenue from other sources.

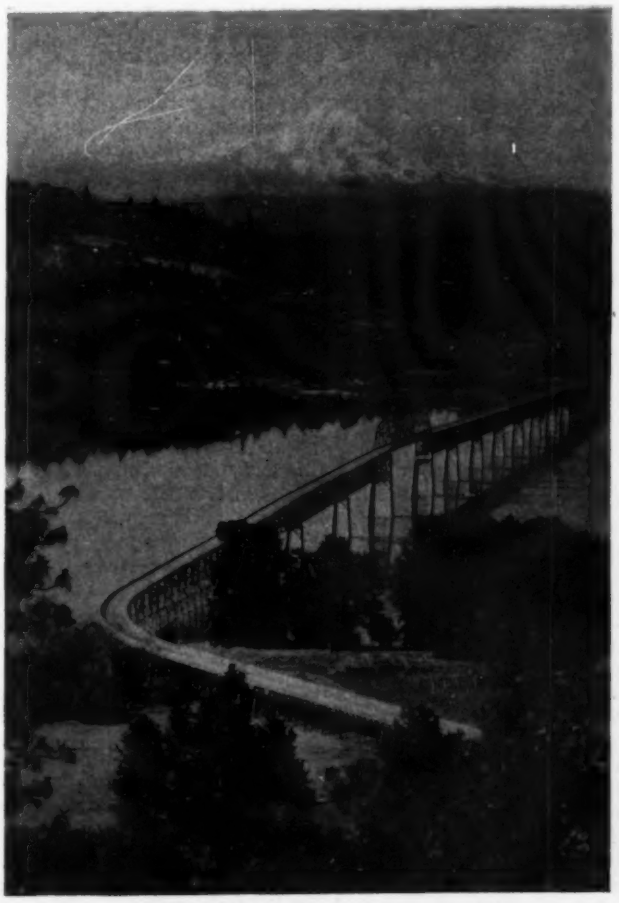
Recent bond issues have been predicated on the gas tax. This has proven sound financing, and inasmuch as returns are steadily increasing and funds available may be readily estimated over a period of years, amortization charges, maturity dates, and annual expenditures can be forecasted with a reasonable degree of accuracy.

Gas Tax—Registration Fees.—Illinois, New York and Massachusetts were the last of the 48 states to authorize the gas tax. Illinois, after some litigation, passed a 3 ct. rate, which became effective in August. It is interesting to note that Massachusetts and New York, the first two states to issue bonds for the financing of highways, were two of the last three states to resort to the gas tax.

That this tax is meeting with popular approval as a method of highway financing throughout the country is evidenced not only by the fact that it is now in effect in 48 states and the District of Columbia, but by the fact that 19 states raised their rates in 1929, and three made their initial ventures, increasing the average rate for the entire country, from 3 ct. to 3 7/10 ct.

The proceeds from this source for the year 1928 amounted to approximately $305,000,000 from a 12,000,000,000 gal. gas consumption and although the present rates do not apply to the total consumption for the whole year, this revenue amounted to approximately 20 per cent of the total state and county expenditure of $1,554,000,000. As the result of increase in rates and the advent of three heavily populated states inaugurating the tax, the revenues by this means should show a further increase in 1929.

It is evident that there has been a rapid change in source of revenue for highway operations during the last decade. In 1921 the proceeds from the gas tax and registration fees amounted to $128,000,000, which was approximately 12 per cent of the total state and county expenditure of $1,036,000,000. In 1928 the total income from gas tax and registration fees amounted to $627,000,000 and was approximately 41 per cent of the total state and county expenditure of $1,554,000,000. Gas taxes and registration fees accounted for 60 per cent of state expenditures. In 1929 the proceeds should approximate 50 per cent of the total disbursements.



The Crossing Over the Columbia River at Hard River, Ore.

Distribution of Funds.—The allocation of a percentage of state gas tax funds to counties is becoming increasingly popular and at the present time 41 states are sharing receipts with counties. That rural highways are in need of funds for improvement in every state is unquestionable. Yet the use of state funds for rural highways before the state system is in a fair degree of completion is not particularly recommended. The through highways accommodate the greater percentage of traffic, probably 90 per cent, and these are the backbone of the country's highway system. The rural highways are the feeders leading into this system, which is the obligation of the state and federal governments and, therefore, state and federal funds should be used exclusively on the trunk line system at least until impassability has been eliminated.

The procedure in North Carolina is worthy of attention. The state highway system as authorized by act of legislature, has been substantially completed principally through financing by the sale of bonds. These being predicated on a

4 ct. gas tax. The 1929 legislature passed the "County Aid Road Act" authorizing an increase of 1 ct. to the existing 4 ct. gas tax, the additional revenue to be allocated to the counties on a basis of 50 per cent by county area and 50 per cent by county population. In addition, $1,000,000 was authorized to be set aside annually from other funds controlled by the highway commission, one-half of which is to be allocated in a manner similar to the County Aid Road Fund, the other half to be expended under the supervision of the state highway commission for the purpose of equalizing road facilities among the various counties of the state.

The act specifies, however, that county highway funds for the current year shall not exceed by more than 10 per cent the expenditures for 1928. This requirement, thereby eliminating the possibility of any further increase in the general tax levy. The act is a relief measure for the benefit of the county property owner without retarding the development of the rural highway.

It is probable that the county aid fund will be increased from time to time, thus furnishing further relief for the county tax payer and will eventually increase the funds to be used on county highways.

Assuming that funds derived from motor vehicle and fuel taxes will steadily increase in the future as they have in the past, and satisfied as to the equitability of these taxes, additional highway finance by bonding is thus made possible. The danger of burdening some tax levies for interest and amortization purposes for highway construction is by this means diminished.

Excess Mileage.—Unquestionably there is a large highway mileage included in the country's local system which has little economic value now and which has discounted possibilities of usefulness for many years hence. A method of elimination presents a difficult problem. In the President's recent message to Congress, this factor was mentioned with the suggestion that uneconomic mileage should be abandoned and turned back into some useful purpose.

In some states legislative acts have been passed which enables the state to take over county highways which have been improved according to state requirements, thus relieving the counties of both mileage and maintenance costs, and allowing funds for further improvements of a permanent sort. In some instances states assume payment of county bond principal, leaving only payment of interest to the county. Unfortunately laws forbidding additional mileage through unproductive territory are lacking. Obviously the trouble is basically a violation of a good engineering principle. In many instances two highways are serving where one would fulfil both present and future necessities, a fact which has been demonstrated by states in the development of their systems. Traffic studies indicate conclusively that loads are greatest within a comparatively short radius circle surrounding population centers. Then logically straight line locations connecting these centers would best serve the present and future economic necessities. This has been the basis for good state location and has eliminated mileage which does not rightfully belong in the state system.

The total mileage of local roads existing at the end of 1928 amounted to 2,709,839. That a percentage of this could be eliminated by relocation is obvious. Also it is evident that this reduction is necessary as an economic step in the development of the rural highway system. Statistics show that this total rural mileage has decreased slightly since 1923, which would indicate that county mileage taken over by states and cities is somewhat in excess of additional mileage in the rural system.

An analysis of construction and maintenance expenditures are interesting and furnish an indication of methods of distribution throughout the country. Considering funds used by state highway departments, the distribution indicates a much greater percentage of expenditure being used for construction operations than for maintenance, the latter being approximately 25 per cent of the total. There is only one state at the present time spending more for maintenance than construction. The situation is quite different with county expenditures, there being 32 states in which county maintenance figures exceed those of construction, although the total construction expenditures are slightly in excess of maintenance.

It is evident that sparsely populated counties have problems to solve which are not present in the more densely populated areas. The demand for passable highways even in areas of small population makes maintenance of some variety mandatory at the expense of the construction of permanent highways.

In speaking of permanent improvements it is not intended to give the impression that high type surfaces should necessarily be constructed, but that a certain percentage of the total expenditure should be used in grading and drainage construction with surfaces chosen to suit traffic conditions.

Economic Planning.—In suggesting a financing plan existing erroneous methods may be considered with indicated method of elimination.

Maintenance funds spent on poorly drained highways result in wasted expenditures. Traffic requirements which demand the continuous placing of new surfacing on either improved or unimproved roads would indicate wasted funds. This may be due to the lack of grading and drainage on unimproved highways or lack of the proper selection of surfacing on improved highways.

Under average traffic conditions experience has proven that earth roads may economically carry 100 vehicles a day; that untreated surfaces constructed of sand-clay, topsoil or gravel may carry without excessive maintenance up to 500 vehicles a day; that surface treatment and macadam may accommodate up to 1,500 vehicles a day and traffic in excess of this figure would demand a surfacing of a standard hard surface pavement. The preceding figures give a very approximate traffic range as a guide to the economic choice of surfacing material.

The maintenance of excessive existing mileage which is unproductive has already been mentioned as uneconomical and relocation suggested as a remedy, this to be the result of careful transportation studies to determine the present and future possibilities.

Construction and Maintenance Funds.—It is obvious that the expenditure of maintenance funds on a system of highways without a certain percentage of construction results in waste which is accumulative, for traffic demands increase each year and maintenance charges grow in proportion unless grading is done and surfaces are built to meet this demand.

Then it is evident that an ideal solution of the financing problem would be the economical fixture of a certain percentage of funds to be used in construction and a certain percentage in maintenance, these to be determined by the degree of completion of the system and the transportation demands. A plan of this sort which provides for the maintenance of only productive highways would undoubtedly liberate a large percentage of funds which in most instances could be used most advantageously for bonding purposes, thereby more rapidly constructing in part at least the primary system, and reducing the maintenance charges on this mileage. It is evident that it is not as desirable to spend funds on the maintenance of poor highways as it is to pay interest on bond money spent on good ones.

A careful analysis of maintenance and construction expenditures is necessary in order to plan an economic system of financing. The percentage of completion of the highway system must necessarily be given due consideration in this analysis, in either county or state, but the county or state which is spending its entire revenue or the greater percentage of it on the maintenance of unimproved highways would do well to investigate its financing methods. On the other hand a high percentage of maintenance costs under conditions which exist in part of the New England area and in counties which have systems substantially completed, do not necessarily indicate excess expenditure for this purpose. In these instances the county systems are

small and it is the township highways that form the major portion of the secondary system.

The greater percentage of counties, however, and those which indicate a necessity for highway development have a comparatively small population and are largely agricultural. In most instances, a very few of the highways carry more than a thousand vehicles a day and for this reason low cost surfaces fufill requirements of existing traffic with low maintenance costs.

There is no state at the present time which does not have a construction program. The expenditures for this purpose have increased steadily during the last fifteen years while maintenance disbursements during recent years have remained approximately constant. The total state mileage has increased from 259,721 miles in 1924 to 308,783 miles in 1929, which increase represents about 50,000 miles or 17 per cent taken over from county systems during the last five years. Traffic on these highways has also increased appreciably during this period.

Definite figures on maintenance savings by reason of steadily expanding construction programs are not available but the easing in maintenance costs despite the traffic increase, and the increase in mileage, show conclusively that these costs are greatly reduced by the construction of serviceable highways.

Every county should have a construction program. Even though income is small, part of this income should be used for permanence on the county system.

The county considering a construction program with a small income can make little headway by the use of current funds. If the demand for highways exists, then the sooner they are built the sooner the benefits accrue. If fixed charges can be met by a bonding investment in highways, then this method should be used, if income is insufficient for this means of financing, then the slower method must be utilized. A choice can only be determined by a careful study of the transportation demands and present and future income.

An Actual County Financing Plan.—The following is an example of financing an agricultural county with small income and small population. In a survey recently made in this county, which is typical of hundreds of others, it was found that the county was maintaining a highway system which included 445 miles in its system. A traffic and economic survey was made and as a result the highway system was found to include excess mileage amounting to 22 per cent of the total. The survey showed that with some changes in location, 345 miles would accomodate present traffic requirements and those of the future with possible surface type development. As a result of this new planning the county system is separated into two classifications which consist of 118 miles of primary highways and 185 miles of secondary highways. There are 42 miles in the present county system which may eventually be added to the existing state system of 55 miles.

There has been very little construction of a permanent nature done on the system and much of it is impassable in wet weather. A portion of the primary system, however, is satisfactorily located, some drainage structures have been built and proposed work will consist of widening, straightening and the completion of drainage structure.

The county has a growing population and is estimated at 15,000 in 1930. That there is a necessity for passable highways is evidenced by the fact that one room school houses furnish 60 per cent of the educational facilities.

Funds for highways are secured through a property tax and a share in the state gas tax. The county has an area of 220,800 acres and had an assessed valuation of $5,267,342 in 1928.

The total funds for highways in 1929 will amount to approximately $36,000, which is the total of gas tax amounting to $18,000 and levies on real estate amounting to $18,000. The highway tax rate in the six districts in the county varies from .20 a hundred to .40 a hundred. There is no bonded indebtedness for highways and a total debt of $81,000 in school bonds against the various districts.

The financing system planned for this county is based on predicted extension of income taken over a period of years. An average annual increase of $2,000 may be anticipated from gas tax. Taxable land values are estimated to double by the year 1960. This would appear to be a conservative estimate in a county with increasing population and a system of highways.

In the financing of the system the object is to build highways to accommodate the greatest population with the least possible mileage. The contemplated plan gives all the assurance possible that highway income over a period of years will be sufficient to meet fixed charges with necessary surplus for maintenance.

A bond issue is planned, a 20 year serial at 5 per cent, the total to amount to $500,000 to be expended in $100,000 units over a period of five years with a deferment period of five years for each unit. This is estimated to complete the primary system of 118 miles.

The highway tax rate necessary to finance this plan will reach its maximum in 1940 and will amount to .43, which is .03 higher than the maximum rate now in effect in the county. From 1940 to 1950 the rate steadily decreases and this levy will be unnecessary after the latter year, the gas tax being sufficient to meet amortization and maintenance requirements.

The bonding plan as described herein may be changed to suit conditions and it is probable that bonds may be retired before their maturity, thereby reducing the total cost. A shorter term serial would materially reduce the total cost but is not practical in this instance due to the resulting increase in tax assessments to burdensome proportions. The sale of bonds will take place over a period of five years giving the construction program opportunity to develop, and new highways to react on transportation. A conservative program of this kind will not tend to upset the labor market, will keep engineering costs at a minimum and be conducive to the greatest degree of economy. Using current funds it would take 15 years to complete the same program, assuming that revenues would show the same increase during the longer construction period as during the shorter one.

Bonding is the only method of financing by which this county can make necessary improvements in its highways either at the present time or in the near future. The investment is unquestionably a sound one and is particularly desirable at this time due to exceedingly low construction prices existing.

Highway Costs.—Figures received from North Carolina and Pennsylvania concerning the trend of highway costs during the past six years show a distinct downward trend. Concrete surfacing is nearly 40 per cent cheaper in North Carolina today than it was in 1923, a reduction in price which has taken place despite a period of rising prices in other fields. Pennsylvania shows a reduction of 25 per cent during the same period. Grading prices have also shown a reduction.

With this easing in construction prices there has developed an improvement in quality, and the pavement which cost $30,000 a mile in 1923 may now be built for $20,000 with the resulting product superior in quality and of much longer life.

With this very satisfactory price trend resulting in permanence in construction, bond financing is particularly

County Financing Plan

$500,000 20 year serial bond issue at 5 per cent. Issues sold annually in five $100,000 units

Year	Estimated Taxable Land Value	Maint. Cost	Bond Cost, Int. & Prin.	Total Cost	Gas Tax	Total Balance	Estimated Road Tax
1930	$ 6,000,000	$30,000	$ 5,000	$35,000	$20,000	$15,000	$0.25
1935	7,000,000	30,000	30,000	60,000	35,000	25,000	.36
1940	8,000,000	35,700	46,250	82,000	47,500	34,500	.43
1945	9,000,000	35,000	40,000	75,000	57,500	17,500	.19
1950	10,000,000	34,250	33,750	68,000	65,000	3,000	.03
1955	11,000,000	38,500	22,500	61,000	70,000	9,000	....
1958	11,600,000	38,500	5,250	44,050	73,000	28,950	....

Note—5 year deferment period for each issue.

desirable. Further guarantee of the highway outlasting the life of the loan is assured.

Highway construction has never been as economical as it is at the present time and the product surpasses in quality and serviceability all previous construction. It is, therefore an opportune time for counties to invest in good roads programs, for roads stimulate transportation and create wealth.

It is well to remember that even though funds for construction increase each year and gas tax rates are also increasing, the vehicle mile cost is decreasing, due partly to motor car improvement and mostly to improvement in highway construction and maintenance. Transportation costs indicate a satisfactory downward trend, which may be expected to continue as production is increased by means of improved methods and machinery.

13 Per Cent Increase in Motor Vehicle Fatalities in 1929

Motor vehicles were responsible for the accidental death of at least 31,500 persons in the United States in 1929, according to "Public Safety," the journal of the National Safety Council.

This figure is based on data from four sources carefully analyzed by the National Safety Council. The reports, while incomplete, are sufficient to justify a fairly close estimate. The estimate includes all types of accident where automobiles or motorcycles were involved.

This total represents an increase of approximately 3,500 deaths over 1928 when 27,966 persons lost their lives in motor vehicle accidents. The indicated increase—between 12.5 and 13.0 per cent—is larger than has occurred in any recent year and is in sharp contrast to the 1929 increase of only 8 per cent in registrations of motor vehicles.

Only a small part of the 3,500 increase in deaths for 1929 can be explained by the population increase, which, according to most reliable estimates, amounted to only slightly more than 1 per cent. The death rate per 100,000 population, therefore, increased from 20.8 in 1928 to an estimated 23.2 in 1929, these rates excluding motorcycle accidents and collisions of automobiles with heavier vehicles.

The comparatively small increase in registered automobiles also caused a sharp increase in the death rate on a registration basis. This rate, which decreased from 157.4 deaths per 100,000 cars registered in 1918 to 95.5 in 1926, jumped to 100.2 in 1927, to 101.7 in 1928 and to an estimated 106.6 in 1929. This is the highest rate, on a registration basis, that has been recorded since 1923, when the motor vehicle accident situation became so bad that President Hoover, then Secretary of Commerce, was moved to call the First National Conference on Street and Highway Safety.

The 1929 increase of 3,500 deaths is the largest that has ever been recorded in the United States or any other country. The percentage increase, while greater than in any recent year, is not so large as in the years when the first large increases in motor vehicle production and registration began.

In the short space of 10 years motor vehicle deaths have now increased approximately threefold. In 1919 the grand total was 11,154 and in the first year of the decade, 12,557. In 1919 motor vehicle deaths represented only 15 per cent of all accidental deaths; in 1929 approximately 32 per cent.

The four primary sources of data mentioned above and used in computing the 1929 estimate are:

1. Direct reports to the National Safety Council from registrars of vital statistics in 39 states and the District of Columbia.

2. Reports on the mortality experience among the 18,000,000 policy-holders of the Metropolitan Life Insurance Company.

3. Reports compiled by the United Census Bureau on motor vehicle deaths in 78 large cities.

4. Monthly reports during 1929 to the National Safety Council from approximately 100 cities.

Thirty-six states and the District of Columbia recently reported comparable figures for 1928 and 1929, most of them for 11 months in each year, which showed about 11 per cent more deaths in 1929 than in the previous year. These states represented a population of approximately 100,000,000 persons, or over 80 per cent of our entire population.

The 11 per cent increase indicated on these provisional reports is almost certain to be exceeded by the final reports because there is uniformly some delay in the filing of death certificates with the state registrar. Therefore, whereas the 1928 reports submitted were final, the 1929 summaries were in most cases provisional, subject to later increase.

The Metroplitan Life Insurance Company has completed tabulations of experience among its policy holders and reports an increase in motor vehicle deaths of 13.3 per cent in 1929. This increase is subject to no revision because of delayed reports and, although the total population covered represents only 15 per cent of that in the entire country, past years have shown that experience among the policy-holders of this large insurance company is especially reliable.

Current reports collected by the United States Census Bureau cover large cities of 100,000 population or more. Information now available covers the 52 week period ending November 30, 1929, and makes a comparison with a similar 52 week period ending Dec. 1, 1928. This experience, from cities only, shows an increase of approximately 15 per cent in 1929. In past years this change has been a reliable indicator of what was happening in the country as a whole. A classification of the state reports received, however, into those states predominantly urban and those predominantly rural, indicated a somewhat greater increase in the predominantly urban states in 1929.

States and cities reporting currently, month by month, during 1929, to the National Safety Council, have experienced, on the basis of present reports, an increase of only 7 per cent in 1929. This figure is subject, however, to two corrections. In the first place corrections have not yet been received in the majority of instances to take account of deaths occurring after a prompt monthly report was submitted. Receipt of these corrections will undoubtedly affect the 1929 record. In the second place this group of cities and states are those that give special attention to the accident problem and it seems reasonable to believe that the record there would be somewhat better than for the entire country.

Of the four sources of data the last one should undoubtedly be discounted most. Of the remaining three the first source of information covered by far the largest area. As previously indicated, also, the third source of data, from large cities only, may not quite represent country-wide conditions. Giving all three of these sources due weight, an estimated increase of 12.5 to 13 per cent and a total of approximately 31,500 would seem not far from the truth. Partial verification of these figures will be possible in the near future when the various states complete 1929 tabulations.

Preventing Skidding on Icy Surfaces by Cinders

Cindering was initiated in Pennsylvania and since has been adopted by other states, modified by some who find cinders unavailable. Sand and other substitutes are employed but cinders have proven superior and remain Pennsylvania's chief weapon against the skid hazard at curves, grades and railway crossings and at such highway intersections as require them.

The department's laboratory, after considerable study, devised a plan to spray the cinders in storage with a solution of calcium chloride, akin to common table salt and a thawing agent. The chemical causes the cinders to penetrate and imbed in the ice, making a permanent tractive surface as long as the ice remains. Cinders without the chemical were found to scatter with the passing of vehicles or slide with the wheels when brakes were applied, and required replacement as often as three times a day.

The use of calcium chloride with the cinders is in such minute quantity that it is lost in the ice before it could harm the pavement.

State Traffic Control in Massachusetts

Expenses in Massachusetts Under the Legislation Adopted in 1928 Providing for Uniform Traffic Signs, Lights, Marking of Signal Systems and Regulations

By MAXWELL HALSEY

Traffic Engineer for Department of Public Works, Commonwealth of Massachusetts

Massachusetts has been a pioneering state in the matter of securing uniform traffic control. Its experiences and success under direct legislation requiring uniformity are set forth in an interesting manner in the accompanying paper, which was presented on Feb. 11 at the 16th annual conferences on highway engineering at the University of Michigan.

STREET traffic engineering has been brought about through the failure of guess-work or political methods to bring about relief from an ever-increasing congestion. Since this congestion is usually caused by a greater increase in the number and use of personal transportation units than in highway development, it is only natural that it should first make itself felt at the junction of major routes of travel. Municipalities have usually grown up at the intersection of trunk lines, and have therefore been the first to apply scientific engineering methods to their problem of street traffic. The expansion of this control to the county, the state, and the region has been a most interesting one.

Necessity for State Control.—There are two important reasons why state control of traffic is necessary. The first of these is the expansion of motoring habits. The automobile and the highway have improved both from the viewpoint of comfort and economy so rapidly that motorists no longer confine their travel to any one community, but normally drive from one city to another, from one county to another, from one state to another, and frequently from one interstate region to another. This expansion of mobility of population has introduced an entirely new factor, that of the necessity for uniformity of traffic control. It is obviously out of the question to expect any motorist to learn a different set of rules and regulations for each municipality through which he finds it necessary to pass. The confusion which results has placed the motorist in such a condition of mental uncertainty as to represent a contributing factor to accidents. This uniformity of control is essential, and some supervisory agent is necessary to maintain it.

The second reason results from conflicting interests of "local" and "through" traffic. Each municipality is primarily interested in its own traffic. Frequently local business interests are so nearsighted in their desire for trade as to subject motorists desiring to pass through the community to almost unbelievable delays in order to make them pass through the business district upon the chance that a certain per cent might wish to make purchases. Consequently, since individual municipalities are not willing to assist through traffic, the burden must be placed elsewhere; and present indications are that the state is in a superior position to bring this about.

There are two chief methods of obtaining uniformity. The first is to hold a series of district conferences under the supervision of some adequate agency and thus to induce the local communities to fall in line and adopt uniformity. The second is much more direct and consists of positive legislation requiring uniformity. In Massachusetts the rapid growth of congestion and non-uniform traffic conditions brought matters to a head in 1928. The Massachusetts Legislative Court chose the second method, and on June 5, 1928, passed Chapter 357, Acts of 1928 "An Act Providing for Uniform Traffic Signs, Lights, Markings, Signal Systems and Regulations."

Uniform Traffic Control Legislation.—There are three main purposes of the Act. First, the elimination of confusion to the motoring public through the accomplishment of a basic uniformity in the signs, signals, and traffic control devices used by the commonwealth and by the cities and towns. Second, the maximum safety and facility of through traffic movements upon state highway routes lying within the corporate limits of cities and towns. (a) By preventing unnecessary obstruction of such routes by improperly placed and operated control devices. (b) By protecting such through routes from dangerous interference from cross traffic by application, where necessary, of the "Through Traffic" or "Boulevard Stop" rule. Third, the creation of a responsible traffic engineering agency in the Department of Public Works capable of cooperating with local officials in developing and administrating safe and uniform methods of traffic control.

The law brings about uniformity by placing the Department of Public Works in a supervisory position, and by requiring that its written approval be obtained upon all signs, lights, markings, signal systems, devices, through ways and regulations relating thereto. This method provides a maximum amount of flexibility and is superior to the passage of laws setting forth definite standards which are apt to be exceedingly difficult to change or to keep up-to-date. By means of the continuing agency established under this act the most modern standards can be effectively maintained. Pursuant to this act, and as a means of putting it into effect, the department undertook a traffic survey.

State Traffic Survey.—The primary function of the survey was to give an accurate picture of present-day traffic conditions throughout the commonwealth. The particular needs as shown by this survey were to serve as a base upon which to erect uniform standards particularly applicable to Massachusetts, but in basic conformity with national standards.

In order to accomplish the purposes set forth above the Department of Public Works secured the services of the Albert Russel Erskine Bureau for Traffic Research, maintained at Harvard University, to make the survey and to establish such agency as would be necessary to carry out the provisions of the act.

The survey began by sending to each municipality an explanatory letter setting forth the requirements of the new law and soliciting its cooperation in the movement towards uniformity. This was immediately followed by a detailed questionnaire covering signs, signals, beacons, through ways, etc. The rest of the survey consisted of vehicular volume studies, speed and obstruction studies, accident investigation and analysis, delay studies, etc., the details of which are discussed more fully at a later point.

The returns from the questionnaires indicated that, while conditions were far from uniform, in general the differences were such that by a series of comparatively minor changes a basic uniformity could be accomplished at an early date. The traffic control signal situation was perhaps the most favorable from the viewpoint of physical characteristics and types of control used, if not from the viewpoint of efficient operation. The warning or flashing beacons were much less uniform and the use of traffic signs and through ways was the least uniform of all. The fact that the people of Massachusetts have been conservative, and that the

commonwealth is in a real sense a compact community, offers unusual opportunities for uniformity in control methods.

Vehicular Volume Count.—The most basic count made was that of vehicular volume. This was designed to determine the use-factor and the comparative importance of each numbered highway. It was taken in sufficient detail to indicate the traffic pattern of the state and to permit the preparation of a complete flow map.

Safety Measures at a Curve on a Massachusetts Highway

In lieu of the customary method of counting each location for a full seven days in order to obtain daily variation, each post was counted by half hour periods for only one day, 7 a. m. to 11 p. m. Then selected key intersections were chosen as being representative and the additional details of daily variation, all night traffic, and classification of types of vehicles were covered at these points. By comparison it was then possible to expand these figures to each post. This method permitted the saving of much labor, and removed the necessity of employing large numbers of men for short periods of time. Individual diagramatic tally sheets were used at all the minor intersections where one or two men were sufficient, while small metallic counters were used at the key stations and others of unusual complexity.

Since the system of numbered routes in Massachusetts includes practically all of the more heavily traveled highways, the first class of locations chosen was the intersection of numbered routes with numbered routes. The only exceptions in this class were those found in the centers of fairly large municipalities. The survey was interested in highway traffic and not in city traffic. Of the first class there were 192. The next class of locations included points of exit of all the numbered routes. The first intersections of any importance in from the state border was selected in each case. Of this class there were 34. In the last class were all of the important highways entering the numbered routes, again excluding the business centers of large cities. Of this class there were 104. Of the total of 386 points, 28 were selected as being typical highway intersections for their particular part of the commonwealth.

The traffic counters were recruited locally in each of the seven highway maintenance districts. They were supervised directly by the district men, and indirectly by the main office.

The following are a few points of general interest. The daily variation is shown in the following table:

	Per Cent
Average day	100
Tuesday	79
Thursday	85
Monday	86
Wednesday	87
Friday	91
Saturday	109
Sunday	163

The per cent of commercial vehicles is shown in the following table:

	Per Cent
Passenger	91
Heavy trucks	4
Light trucks	4
Busses	1

The per cent of night travel is shown by the following table:

	Per Cent
Wednesday	9
Saturday	9
Sunday	7

Speed and Obstruction.—An equally important characteristic of highway travel is speed. Thus, for example, it is impossible to obtain a fair comparison of the accidents at different sections of highways unless not only the amount of travel using each highway, but the speed at which it travels is known. The department studies along this line have not yet been completed, but those taken tend to show high speeds in the areas which report numerous accidents. They also show the large amount of delay brought about by the passage of truck lines through the business centers of small or large communities.

Accident Investigation.—The department is also carrying on a rather unusual accident study. Two of the factors regarding accidents which are frequently difficult to obtain are exact location (within 100 ft.) and highway construction characteristics, such as grades, curves and types of pavement. For this purpose a new form has been developed. One of the faults evidenced in the past has been that accident reports have come in from four different agencies upon four different types of report forms. The new form is intended, to be used by the Registry of Motor Vehicle Inspectors, by the state police, by the local police and (a modified version of it) by the operators themselves. The use of a standard accident form giving more exact locations will do much to assist in the prevention of accidents. A large spot map with a scale of one mile to the inch is being maintained, as is a detailed ledger wherein each accident is charged to a particular location. As the accidents accumulate the more hazardous points can be picked out for special study, and the most dangerous lengthes of highway may be selected for patrol.

Other Special Studies.—The department has also been carrying on special studies of delays at congested intersections, and of special turning movements in order that it may determine what types of control are necessary and when grade separations are justifiable. Plans have also been made for an origin and destination study, which will probably be taken during the summer.

Preparation of Uniform Codes.—In order to assist in the business of making approvals, and as an aid to the cities and towns, the department is preparing a series of uniform codes for traffic control which set forth the standards required before its approval will be given. In view of the large amount of current interest shown, it has been decided to issue these codes in order of their importance as fast as they are completed. Bulletin No. 1, "Recommendations and Requirements Relating to Through Ways," and Bulletin No. 2, "A Standard Code for Traffic Control Signal Installation and Operation," have already been published. Bulletin No. 3, "A Standard Code for Traffic Signs, Markings, Beacons and Islands," is in the final process of completion and should be released within the next two months. Bulletin No. 4 is in its initial stages and will represent a model municipal traffic ordinance for Massachusetts.

All new installations must be in accordance with standards set forth in the above codes. All existing equipment which has not been considered hazardous has been approved conditionally with a fixed period of time set for any necessary changes. In the

case of comparatively new equipment non-uniform in a non-dangerous way some of these periods have been set for as long as two years. Thus it will be a few years before all the minor non-uniformities have been corrected.

All codes are based, first, upon established national standards, secondly, upon the peculiar requirements of Massachusetts. They are intended to be of sufficient detail to cover average conditions and will be brought up to date year by year.

The following description sets forth the fundamental material contained in the finished codes.

Bulletin No. 1.—Recommendations and Requirements Relating to Through Ways

The bulletin begins by giving the statutory provisions respecting through way regulation. Under the law the Department of Public Works may upon its own initiative designate through ways, or cities and towns may do so with the written approval of the department.

The Massachusetts through way law is similar to that of the model municipal code in that it does not in any way affect the right-of-way law. The requirement to stop is merely a condition which is made precedent to entering a through way. Once the motorist has stopped and then starts to enter, the usual right-of-way rule applies. If he enters the intersection first he has the right-of-way. If he enters upon the right at the same time that another motorist enters from the left, he has the right of way, while if he enters from the left at the same time that another driver enters from the right, the latter has the right of way.

The law requires that no through way regulation shall be made effective until all the signs required by the department have been erected, thus guaranteeing the motorist an adequate warning.

Purpose of Through Way Regulation.—The main purpose of a through way regulation is to increase the facility and safety of traffic flow upon major routes of travel by giving the operators upon such routes a provisional right-of-way over traffic entering from cross streets, and by insuring that progress will not be endangered by vehicles that enter from cross streets at a high rate of speed. Increased facility is gained by the reduction of interruption rather than by an increase in operating speed, for nowhere in the statute is permission given for higher speeds.

Proper Conditions for the Application of Through Way Rules.—The through way rule is of a highly specialized character, and, if not applied in proper locations under correct rules of operation, will not be effective, and will thus break down its general application.

Strict police supervision is difficult because of the area covered, but adequate enforcement must be maintained to educate motorists to this type of regulation which requires of them a high factor of inconvenience. Voluntary obedience will be in ratio to the reasonableness of application.

The most important condition which must exist if a through way is to be successful is a strong predominance of traffic upon the through way. Obviously it is impossible to expect vehicles from the side street to stop when there is found but an equal number upon the through way. Unless a feeling of the superior importance of the through way can be instantly developed in the minds of the motorist approaching from the side street, he will not be willing to stop. If the side street volume is very heavy the actual process of stopping will become a difficult one. At a few such points traffic signals may be used.

The second requirement is that the traffic upon the through way shall be comparatively fast as well as frequent and consistent. If it is not fast, the safety value of the through way principle is not needed. If it is not consistent, enforcement is difficult for the operator of a vehicle entering from a side street will not be apt to stop voluntarily when no traffic is in sight upon the through way.

The third requirement is that through ways shall not be closely parallel. Too frequent stops by cross traffic result in irritation and disobedience.

The department is not approving the use of isolated stop signs. If "through traffic," the condition of which the signs warns, exists, then each intersection should be covered. If not, and some blind or hidden corner is the hazard, some different treatment, such as the use of diamond-shaped warning signs, flashing beacons, or semi-actuated traffic signals should be used in order that the danger may not be confused with that of a through way.

Signs for Through Way Marking.—The code contains detailed specifications of the required sign which are almost identical with those required by the Report of the Committee of American Engineering Council on Street Traffic Signs, Signals and Markings. It is an octagonal sign, with red lettering and border upon a yellow background. These signs are to be mounted from 6 to 8 ft. high to provide adequate visibility over the top of parked vehicles. Supports are to be painted with alternate yellow and black stripes 6 in. in width sloping at an angle of 45 deg. These signs are required to be illuminated by

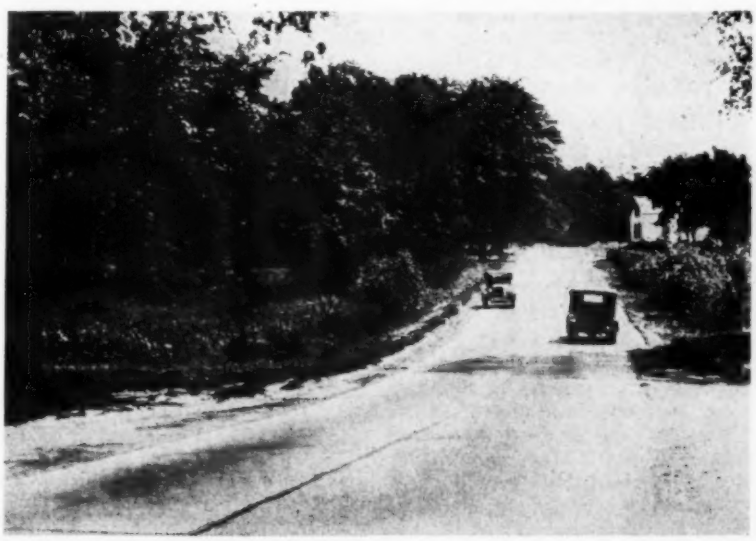
(a) Lights flooding the face of the sign;
(b) Self-contained uncolored lamp showing through clear lens to form the reqiured words;
(c) Reflecting, uncolored element forming the required words to be illuminated by headlights of vehicles.

Since it is important that those upon through ways know where protection begins and ends, limit markers are required. These signs are rectangular with black lettering and border upon a white background. The message reads "Through Way Begins Here" or "Through Way Ends Here." Their mounting height and illumination are the same as those of the stop sign. They are required to be used upon the right hand side of the roadway.

A Standard Code for Traffic Control Signal Installation and Operation

If traffic control signals are to be effective they must be used only where there is a legitimate demand for them; they must be of good design, they must be installed correctly, and they must be operated properly. To meet these requirements the code establishes standards of utility, design, installation and operation.

Standards of Utility.—In order to



Border Planting on a State Highway in Massachusetts

prevent the installation of unnecessary and harmful signals, the code provides that no signal may be installed or operated unless conditions warrant its use. Minimum conditions are established below which approvals will not be given. Where installations are to be justified solely by vehicular volume, there must be at least 500 vehicles entering the intersection per hour, of which 25 per cent, or 125 vehicles, must be upon the cross street. It should be remembered that this figure is strictly minimum and is not to be taken as a condition for which the department would recommend a signal installation. It is merely used to prevent installations which would be of a detrimental character until such time as the engineering studies now under way may be completed and a scientific basis for volume requirements established. If pedestrian traffic is to warrant the installation, there must be at least 250 pedestrians crossing the intersection each hour in addition to the requirement of 500 vehicles per hour. It will be noticed that the number of pedestrians merely replaces the amount of cross traffic required. Unless there exists a conflict of movement either between vehicles or between vehicles and pedestrians, there is no necessity for signals as far as the mere volume is concerned. If signals are to be justified by a necessity to control speed, excessive average speeds must be shown. If an additional signal is to be installed upon the basis that it is needed to assist an existing system, then it must be shown that it will add to the efficiency of that system. Where unusual conditions exist traffic-actuated devices may be installed regardless of the above restrictions. Any of the above warranting conditions must be shown by actual traffic counts, thus placing the entire method of justifying signals upon an engineering basis.

Standards of Design.—In order to make it possible for all motorists to be faced with traffic signals which appear the same and give similar indications, the code has specified the type of signal indication to be used. The type of signal chosen is that now in use in a great majority of installations throughout the country. The standards provide for a signal face having three round lenses with a diameter of 8 in. each. These lenses are to be red, yellow and green, with the red lens at the top, the yellow lens in the middle and the green lens at the bottom. Where special turning conditions require it, a green arrow is permitted. This must be located below the green lens. Lettering is not permitted on lenses because it impairs visibility, and the meaning of colors is legally specified. In order to insure a good signal indication lenses are required to be independently illuminated by a traffic lamp of not less than 60 watts, and to have a visibility from all points up to 300 ft. The colors used in signals are required to have the following meanings: Red is a stop indication. Yellow is a change indication. Green is a go indication, and where the green arrow is permitted, it is a turn indication. Where the red and yellow lenses are shown simultaneously they constitute a special pedestrian period indication. The flashing red is a stop-before-entering indication, and may be used only upon through ways or boulevard stop streets. The flashing yellow is a cautionary indication.

Standards of Installation.—In order that motorists may be guaranteed good visibility, and may know where to expect to find traffic signals at intersections, the code has specified standards which will give a uniform location and provide visibility sufficiently in advance of the intersection to permit a vehicle to stop before reaching it. The control indications of each installation are limited to vehicles within one block of said intersection. The location chosen as standard is the far right corner. This provides for four signals at the average intersection, and instructs the motorist to expect to find all his indications upon the far right. The only exception to this location is at intersections where the street area is so large that it permits the placing of a traffic island, which location in some instances represents the best place for control signals. When a signal is located upon the far right corner, it is usually placed at the intersection of the curb line of the street whose traffic it controls and the property line of the intersecting street. The far right corner location for traffic signals has been chosen because it can be used in the majority of intersections, because it gives the best visibility, and because, being out of the roadway proper, it does not interfere with turning movements. The height of signals is placed at not less than 8 ft., to insure visibility over the top of the average parked car, nor more than 16 ft., to keep signals from being placed so high as to be invisible because of sun visors or the tops of cars. Whenever signals are over the roadway they must be 14 ft. 6 in. above the surface of the pavement to give clearance for trucks. The most common height will be 8 to 10 ft. Signals must be located in every case so as to give approaching traffic a signal indication from all points up to 150 ft. This is to provide adequate braking distances for speeds up to 40 miles per hour. The code also specifies that signals shall not be more than 100 ft. from the point where vehicles are expected to stop. This guarantees positive indications and prevents confusion as to whether the signal is for the approaching or the next intersection. All signals are required to be shielded in such a manner that the approaching motorist will see only the signal intended for his direction.

Standards of Operation.—There are many signals of good design which are properly installed at intersections where there is a legitimate demand for them but which are not effective because of their improper operation. In order to secure efficient operation and to provide the motorist with a consistent method of signal control with which he may easily become acquainted, the code establishes standards of operation. The first requirement follows general railroad practice and requires that all signals must operate continuously, either as control devices (stop and go) or as warning devices (flashing yellow, or, in the case of through ways, flashing red upon the side street and flashing yellow upon the through way). In other words, there shall be no dead signals, thus whenever a motorist sees a dark signal it will be an indication to him that the signal is out of order and that he should exercise more than ordinary caution.

The next provision requires that traffic signals may operate as control devices only when conditions warrant control, as established in standards of utility, and that at all other times they must act as warning devices, giving indications of a flashing character. The only exceptions to this are progressive systems and traffic actuated devices, which because they do not cause unnecessary delay may operate continuously regardless of how light the traffic may be. The most evident result of this requirement is that during the late hours of the night motorists will not be stopped and required to wait unnecessarily when there exists no cross traffic. Instead, they will be required by the flashing indication to cross the intersection slowly and with caution.

Since one of the greatest evils of modern traffic control signal operation is the use of excessively long time cycles, the code establishes maximum lengths of cycle. Three classifications are established. Intersections with three or four entering ways have a maximum of 60 seconds; those with five entering ways 80 seconds, and special intersections with unusual conditions have a maximum of 120 seconds. When a special pedestrian interval is employed, an additional 20 seconds is allowed. Periods or intervals are required to rotate in order to prevent giving one period more than once in a single cycle. Periods must always be in proportion to the amount of traffic using them. The code required that traffic counts be taken and that the signals be timed in actual proportion to the traffic arriving upon each street.

Another common ailment among present signal operations is the use of an excessive number of periods or intervals, a practice which reduces the capacity of the intersection materially. To prevent this, the code establishes maximums. Intersections with three or four entering ways may have only two periods, those with five entering ways may have three movements, and special

intersections four movements. This does not include special pedestrian periods, and when they are used an additional interval may be allowed. The yellow change period is required following the green signal for a period of from 3 to 5 seconds. This time is necessary to provide adequate braking distance for those who are about to stop. A change period is permitted following the red, but is not required. The yellow may be displayed either with the green as an overlap or alone. It must be displayed independently of the red or it would be confused with the special pedestrian period. Where the special pedestrian period is used, the code specifies that it shall not be longer than 20 seconds nor less than 15 seconds.

Still another of the harmful practices being used in current signal operation is that of erecting a series of adjacent installations and of not providing for any type of coordination. This means that the motorist is never sure of getting through more than one of them without being delayed. To prevent this type of operation the code requires that whenever signals are within 2,000 ft. of each other they must be coordinated. The code limits the so-called simultaneous type of coordination, which gives all green indications in the same direction at the same time, to systems of not more than two signals, due to the fact that this system encourages speeding and is low in efficiency when compared to the other types. The limited progressive system which gives every other indication the same color is limited to localities where the street blocks are of equal length, and where traffic demands are approximately the same at all intersections, for, unless these conditions are present, the limited progressive systems cannot work efficiently. The flexible progressive system of coordination is permitted and recommended everywhere since it is the most efficient method yet devised. In order to move through a whole system of coordinated signals the motorist must drive his vehicle at the speed for which the signals are timed, and therefore the code requires that signs be erected stating the speed.

Wherever traffic signals are installed at intersections adjacent to railroad grade crossings, the code requires that the railway warning devices be interconnected with the signals in such a manner that when the warning signal indicates the approach of a train, the control signals will give traffic approaching the crossing a stop indication. In all cases a signal must be installed between approaching traffic and the grade crossing. In addition, a signal must be provided for enginemen to indicate whether or not appoaching traffic has been given a stop indication.

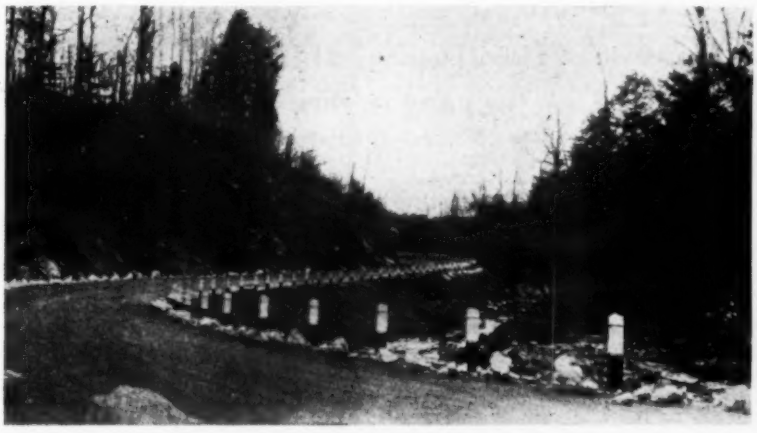
The Effect Upon the Motorist.—In summarizing them the standards set forth by the code will, from the viewpoint of the motorist, establish the following:

First: He will not be delayed by signals installed at locations where they are not needed. Neither will he be delayed by signal operating at times of the day or night when traffic is too light to warrant control operation. In other words, the only time he will be stopped will be when there is a legitimate utility for the signal which requires him to stop.

Second: He will be faced by uniform signals. He will know that when he finds a three-color signal he must proceed on green, wait on yellow, and stop on red, and that where a four-or-five lens signal is provided, there are special movements involved and he must make the turns indicated by the arrow only when said arrows are illuminated. He will also know that when he finds a flashing red signal he is approaching a through way and is required to come to a full stop before entering the intersection. He will also know that whenever he sees a flashing yellow indication that there is some particular hazard at that intersection and he is required to proceed with caution.

Third: He will know that he is to expect to find his signal indication upon the far right hand corner, and that he does not have to obey the commands which it gives until he is within one block of it. He will know that he will be able to see every signal 150 ft. in advance of the intersection, and thus will be able to stop in case the indication should be red. He will know that he will never be required to stop more than 100 ft. away from the signal which is controlling his actions. He will also know that due to proper shielding he will be able to see only the signal intended for his direction.

Fourth: He will know that all signals are operating continuously, and that if he finds a signal dark it is out of order and he must exercise caution lest the traffic upon the other street shall have the green signal. He will know that the cycles are not excessively long, and that he will not be required to wait an unnecessary length of time. He will know that the street upon which he is traveling will receive its full share of the cycle. He will know that when he is proceeding upon the green, he will receive a 3-5 second warning period of yellow, so that if he is too close to the intersection to stop in safety he may have time to cross the intersection before cross traffic is released. He will know that where he can see several signals ahead, they will be coordinated, and that if he will drive his vehicle at the speed posted on the signs, he will be able to drive right through the entire system without being required to stop. He will also know that if a railroad grade crossing is adjacent to a signalized intersection, he will be given a stop indication in the event of a train crossing the tracks.



Section of State Highway in Town of Becket, Mass.

Thus the motorist may travel from one jurisdiction to another with a knowledge that all control devices will be basically the same as those to which he is accustomed in his own locality. With this understanding he will be in a better position to avoid accidents.

Permanent Traffic Engineering Agency.—The Department of Public Works has established the position of "Associate Highway Traffic Engineer." This office is under the maintenance engineer's office, one of the four main divisions of the department. The personnel of the traffic engineering office consists at present of a traffic engineer, an assistant traffic engineer, three traffic investigators, and the usual stenographic and drafting assistance. In addition to this main office personnel, general assistance is obtained from each of the seven highway districts. All survey and special studies are carried on with the assistance of temporary employees.

Success to Date.—The general movement toward uniformity under Chapter 357, Acts of 1928, has been most successful. The municipalities have offered their full cooperation. Their general feeling is that the commonwealth is acting as a sort of a clearing house

where they may obtain engineering advice. Frequently the local public officials are more than anxious to have standards erected by the state in order to evade the political difficulties within their own community.

The departmental procedure in making approvals has been to receive written and signed applications upon forms supplied by the department. These applications are then investigated in the field and recommendations made by the traffic engineer to the board of commissioners who sign the written approval of the department which is required by law.

The volume and activity shown in connection with traffic control signals and through ways is of unusual interest. Since the beginning of Chapter 357, Acts of 1928, 522 permits for traffic control signals have been issued, of which 293 were existing installations and 229 were new installations. Twenty-four permits (comprising 60 streets) have been issued for through ways. The activity is naturally heaviest during the summer months, but remains fairly heavy all through the winter.

Application of Asphalt Filler

A Discussion of Hand Pouring and Joint Filling by Machine

By EARL H. NEWELL

Engineer, Lewis & Copeland Construction Co., Lima, O.

POURING the filler on a brick road is an operation of great importance. Good judgment of suitable working conditions is necessary as well as control of all the details of the pouring. High class results are quite easily obtained when the weather is hot and dry. All the brick jobs I have helped build have been summer operations as far as the brick work was concerned.

Importance of Perfect Penetration.—By far the most important one item to strive for on a brick road is to get perfect penetration or sealing of every crack and crevice around each brick. The time required to deliver the asphalt from the kettle to its place between the brick as filler is, in any method of pouring, one of the principal factors for determining the efficiency of the method. When asphalt is near the temperature of 350 to 400 deg. permitted by most specifications, it will run readily into a very fine crack, but if the method used permits the asphalt to cool much before actually in place, the result is bridging or filling of the tops only of the smaller cracks.

Any possible entry for moisture in a brick top is likely to have disastrous results in the life and service of the pavement. The seal must also bond the individual brick together with a rigidity that will stand the heaviest of traffic and still have an elasticity that will not be broken by the contraction of temperature changes. If asphalt is not heated above the temperature allowed it will have the elasticity and strength of bond required.

Hand Pouring.—On the first brick jobs I helped build, we applied the asphalt with coal buckets directly to the surface and pushed and spread it with squeegees. This method in warm weather seemed to give good results, although it was wasteful, leaving excess asphalt on the top. The finished job was rather messy looking, but the excess asphalt in most cases disappeared quite soon under traffic.

Machine Application.—A new machine is now in use for applying the filler. It is called a squeegee machine. It is an angle iron bent to a half circle with a soft rubber belt ½ in. thick bolted to it—as the squeegee member. A 12 gal. tank mounted above the squeegee discharges through a 1-in. valve just in front of the belt. The machine is pulled with two handles and has a conveniently located throttle to regulate the flow of asphalt. When the operator is pulling the machine the entire weight is on the belt.

The curved section of the squeegee confines the asphalt and as the operator controls his speed and the flow of asphalt he can pour a uniform strip about 20 in. wide. A tank pours a strip of about 40 lin. ft. and takes about 1 minute to 1½ minutes to pour. Two trips over are necessary to properly fill. As the tank discharges ahead of the belt there is about a gallon of asphalt on the surface and I think four or five seconds is the maximum length of time any of the asphalt is in the process of delivery to the joints.

The weight of this machine on the belt wipes the surface absolutely clean except for a film of about 1/64 in. A set of wheels facilitates moving this machine when not in the pouring operation.

The following remarks cover our job on which 3-in. lug brick with lugs slightly over ⅛ in. were used.

Observation of side flow when going over the first time with this machine indicate 100 per cent penetration. Pulling a brick out of the top after pouring and while still hot also showed perfect filling in the bottoms. In no case, was a crevice open that was not sealed at the bottom. We used this method on about a mile of the service test road built on the Wm. Penn highway in Western Pennsylvania.

Pouring with Hand Pots.—About 5 miles of the same job were poured with hand pouring pots. We tried turnip shaped pots with a throttle on handle and long spouted joint pouring cans, but we found 2 qt. coffee pots with the strainers cut out of the spouts to be the best.

We serviced these pots with a large spouted can. Most of the pouring was done by boys 15 to 18 years of age. They were more more adept and cheaper. We laid off ten courses to a section and the boy who poured a section about 30 minutes after finishing it looked it over and patched any places that had settled before sanding.

This operation required continual watching. The average day's pouring required each boy to pour 100 pots of asphalt or 6 minutes to each one. A large percentage of the hand poured asphalt was poured at a temperature far below the minimum temperature permitted. When the asphalt thickened hot stuff was added, but at all times the temperature control was very crude. If pouring the individual cracks is to be continued some device must be developed that can be handled speedily enough to insure placing of the asphalt at the required temperature.

Most joints with this hand poured method have a protective ribbon or ridge of asphalt from ½ to 1½ in. wide. Extremely hot or windy weather made it impossible to keep the joints neatly poured. Labor turnover also affected it some.

About 5 per cent of the joints where the hand pouring was used are not perfectly filled and some of the settlements indicate considerable bridging. The annealing action of traffic on the excess ridges may close some of these cracks.

On a section about a third of a mile long poured during last May we scraped off the hand poured ridges. With no excess on top of the joint to anneal into the settlements this section showed quite serious settlement.

I feel that both methods used on this job produced good results and that this brick road will give good service for many years.

Acknowledgment.—The foregoing is a paper presented at the last annual convention of the National Paving Brick Manufacturers' Association.

Highways in Canada.—At the end of 1928 there were 381,976.7 miles of highway open for traffic in Canada. Of this total, 41 per cent was unimproved earth; 42 per cent improved earth; 15 per cent gravel and the remainder waterbound macadam, cement concrete, bituminous macadam and bituminous concrete. According to distribution by provinces, 40 per cent of all the highways were in Saskatchewan; 17 per cent in Ontario and 8 per cent in Quebec. The remainder was distributed among the other provinces.

Resurfacing and Salvaging Existing Pavements

General Principles and Methods and Specific Projects Where Various Types Have Been Used Successfully

THE subject of resurfacing and salvaging existing pavements is one of much economic importance. Pavements built in past years were designed principally for a type of traffic which is now obsolete. Thus many streets have failed because they have been called upon to carry a different type of traffic than that for which they were designed. An interesting discussion of the subject was given in the report of a subcommittee of the City Officials' Division of the American Road Builders' Association, which was presented at the recent convention of the association. The notes following are taken from the report.

Where pavement failure is due to inadequate drainage or insufficient strength of the foundations, the only solution of this problem is the replacing of the entire existing structure by a new pavement.

There are many problems regarding grades, drainage, profiles and crown of the existing roadbeds that have to be worked out to the best advantage on each resurfacing project.

Advantages of Salvaging.—By salvaging existing pavements, the existing subgrade stability and beaming power is not destroyed. The existing metal is reclaimed and its useful life is continued with a corresponding decrease in construction and maintenance costs.

In the greater percentage of instances, when drainage conditions are good and where there is ample subgrade stability, it is economical to utilize the old pavement material as a base for the new.

If failure is due to inadequate drainage or lack of subgrade strength, new pavement should be placed with adequate slab strength to provide for modern traffic loads.

By utilizing the old base and adding new material, greater thickness and strength result.

Type of Failure.—The failure of these old existing pavements have been in general of two kinds:

(1) Wearing out of the surface.
(2) Failure of the foundation.

Pavements which have broken down from inadequate or insufficient foundations will generally have to be entirely rebuilt. It is possible, however, to utilize certain of these foundations by adding more material. This material for rebuilding, retreading and resurfacing old pavements comes under four general types: brick, asphalt, concrete and macadam.

APPLICATION

Relaying Brick.—W. D. Sheddan, City Engineer of Jacksonville, Fla., has had some very interesting experience in the problem of handling brick streets that were constructed from 15 to 30 years ago. Many of these streets have been relaid on an 8-in. lime rock base utilizing from 50 to 75 per cent of the old brick. Out of 15 projects which the city recently installed 8 were relayed jobs. These have shown a saving of 61 ct. per square yard over the cost of entirely new pavement. This really represents only the value of the brick which have been reclaimed, as on these jobs the curb has been reset and a new base constructed.

Resurfacing Brick with Bituminous Surface Course.—On brick streets where the foundation is adequate, many pavements have been put into first class condition by resurfacing the brick with sheet asphalt, using 1½-in. binder course with additional binder to fill any depressions in the old pavement, and then adding 1 in. or 1½ in. of sheet asphalt. This, of course, necessitates the adjustment of all manhole covers, inlets and other structures in the pavement to the grade of the new surfaces. It also requires the relaying of the flow line of the gutter from 2 to 3 in. below the existing gutter in order that the full thickness of the new surface may be carried to the curb. These adjustments constitute one of the objections to the use of sheet asphalt for this work. Where such installations have been made, however, the results have been entirely successful and the public has been well pleased with the completed improvement.

The experience of the City of Niles, Mich., in salvaging an old brick pavement will be of interest. Niles is a city of 15,000 population with very heavy tourist and trucking traffic into the resort and fruit sections. Most of the earlier pavements have been brick or sheet asphalt on either natural cement concrete or macadam foundation, and have given excellent service. On Front St., however, a brick pavement was laid on only a sand foundation. This street parallels St. Joseph River, and the low, swampy ground had been filled from 1 to 5 ft. to provide a proper grade. Parts of the street have been under water from ice gorges in the river.

A few years ago this street became a part of one of the main north and south Federal highways. This section of pavement had in its 25 years of service, become very rough from settlement and wear. It was desirable to correct this condition at once and arrangements were made with an outfit that had been working on the county roads in the vicinity, to patch the lowest places with hot bituminous material and crushed stone. After the patching, the entire surface was carefully swept and treated with 0.4 gal. of cut-back bituminous material; then covered with limestone chips. The cost of patching was 3 ct. per square yard and the cost of surface treatment was 15 ct. per square yard. The riding quality of the street was very much improved and the result was considered satisfactory.

It was felt that the better way to handle the repair of the street would have been to set aside the funds for that season and then make a more permanent improvement as funds became available. It is true, particularly in municipal work, that the public soon forgets the cost of an improvement, but they note how often it is necessary to make repairs or renewals. As was expected, the thin carpet coat broke through in places under the exceptionally hard winter traffic. In the spring the roadway still presented a smooth and satisfactory riding surface, but the appearance was not very pleasing, as it gave the impression of having failed.

It was recommended that another carpet coat be added the following season, using a slightly different bituminous material, but the city authorities felt that the work done should be of a more permanent nature. Resurfacing with sheet asphalt or relaying the brick on a new concrete base was considered, and assessing a portion of the cost against the abutting property. However, if the expense had been incurred of placing such a pavement on the street, good practice required all underground structures to be in proper condition. This would mean the replacing of all iron water services with lead pipes and the relaying of the sanitary sewers and lateral branches to the curb. If the old pavement was cut to pieces with all these trenches, then the value of the old pavement as a base would be entirely destroyed. After considering all sides of the matter, it was decided to apply a surface of rock-asphalt to as much of the street as the funds on hand would permit.

Rock-Asphalt Surfacing.—The pavement has a width of 36 and 46 ft. In order to cover as much of the traveled surface as possible, a strip 8 ft. wide adjacent to each curb was left without any further treatment, as this space is used for parking. The portion resurfaced was carefully swept and given a thin coat of cut-back asphalt, using about 1/20 gal. to the square yard. Some concern was felt as to the result that would be obtained over the patches placed the year before as an excess of bituminous material had been used and the patches were bleeding

somewhat. For this reason less asphalt was used in the paint coat than is ordinarily recommended. The labor forces were inexperienced and the only equipment used were forks, shovels, rakes and a 5-ton roller.

In applying the rock-asphalt, the aim was to secure a finished thickness of not less than ¾ in. The maximum depth in the holes was about 1½ in. One-inch wooden strips were laid along the pavement parallel to the centerline and spaced about 4 ft. apart. These were used as guides in spreading the material. After the material was spread, the strips were moved ahead and the spaces thus left were filled with additional material. The practice was to let the material stand until late in the afternoon before rolling. At the close of the day's work the section completed was opened to traffic. All sections laid one day were rerolled the next afternoon to take out any traffic marks that had developed. The result obtained at first did not compare with a sheet asphalt surface, but traffic has continued to iron out the small inequalities and now the street presents a surprisingly compact surface.

Resurfacing with Bituminous Mixtures.—There are various types of bituminous mixtures now in use that have the characteristic of adhering to the old pavement and standing up under traffic even though the thickness of the applied surface is run out to a feather edge. Many of these mixtures can be applied cold and consequently are very convenient to use on municipal work. Various brands of mixtures of sandstone or limestone with asphalt are now on the market and are meeting with general favor in reconstruction work. A number of cities have used a surface treatment of cut-back asphalt or tar with gravel or stone in what is commonly termed a "retread." The bituminous material and stone are spread on the old pavement and then mixed by means of blade graders or similar equipment and finally shaped for traffic. This type of work is more suitable for maintaining and building up macadam streets, although it has been used successfully on other kinds of pavements.

In the case of asphalt pavements the method is to use surface heaters for softening the existing pavement and then add a new surface of 1 to 1½ in. of sheet asphalt. This replaces the asphalt that has been worn out under traffic. Retreading carpet coats of bituminous materials are also used successfully on asphalt pavements, although one does not ordinarily think of this method of maintenance for such a high class type.

Macadam.—Salvaging and resurfacing macadam roads is being accomplished economically and successfully in many parts of the country. In a great many instances an existing macadam street is an ideal base for a bituminous wearing surface. With this method the existing subgrade stability and bearing power is not destroyed. The existing metal is reclaimed and its useful life is continued with a corresponding decrease in construction and maintenance costs.

There are many methods of salvaging. Scarifying, reshaping and adding new material are serving these purposes in some localities. The method which is popular in many sections, consists of resurfacing, either water-bound or penetration macadam with hot or cold bituminous mixtures. The construction methods are simple, consisting of the construction of concrete headers along the sides of the old pavement, which may be designed for widening purposes if necessary.

The bituminous mixture, hot or cold, is usually laid in two courses, known as binder and top. This is generally preferable to a one course surfacing, as the coarser aggregate binder with its greater stability is used to fill up irregularities and depressions in the old macadam.

This method is being used extensively in the state of Maryland and in Washington, D. C. The District of Columbia has a formula for a very satisfactory surfacing material which is being used extensively on old macadams throughout the city. The binder course includes aggregate ranging from ⅝ in. up to 2 in. and the top course having aggregate that must pass the ⅝-in. screen and be retained on a No. 8 mesh. Cut-back asphalt is used heated to about 150 deg. mixed in a central plant and hauled to the work. The mixture is workable, may be stock-piled and handled with a power shovel. It is being used in Washington to some extent for patching, but primarily as a pavement surfacing material.

The cost of this method of salvaging ranges from $0.50 to $0.80 a square yard, depending on whether scarifying and reshaping is necessary. The impracticability of raising grades on city streets in many instances makes scarifying mandatory.

Concrete.—The City of Champaign, Ill., has utilized old concrete pavements as bases for new construction. Their plan has been to increase the width of the old pavement with a 7-in. slab from the curb line to the edge of the existing pavement and then reduce the thickness of the new slab to 6 in. over the old concrete. The reinforcement used in the 7-in. new slab was 42 lb. of mesh, while 57.8 lb. of mesh was used in the 6-in. slab.

The money saved by utilizing the old concrete base amounted to very little, except the finished pavement had the advantage of added strength.

Mr. J. C. Walker of the North Carolina Highway Commission, Asheville, reports that on the Biltmore-Hendersonville section, which consists of an 18-ft. concrete slab 4 in. thick, rich mix placed on an old worn out, badly broken 6-in. county built concrete road, is now in excellent condition. Some apprehension was felt at the time of construction, fearing that the two slabs would bond and that cracking already present in the lower slab would be transmitted through the upper slab. It was further feared that the unequal contraction of the surface layer exposed to very cold air would exceed that of the lower course with subsequent extreme cracking appearing in the upper surface.

To eliminate this, transverse planes of weakness were installed at intervals of 30, 50 and 70 ft. All the additional cracking which has appeared came about within the first few weeks after construction and no additional cracks have been noted, although this pavement is now two years old and carries a very large volume of fast moving traffic, including a large percentage of heavily loaded solid-tired trucks.

In this instance the method used has proven economical. It should be borne in mind, however, that the failure of the original surfacing was not due to subgrade weakness but to other causes. The old concrete surfacing was not built according to the requirements of modern specification, resulting in an uneven surface and also was lacking in strength and thickness in some sections. The ultimate failure was caused by the continuous pounding of heavy truck traffic.

British Highway Engineers Form Association

Engineers and surveyors of Great Britain engaged in highway work have organized the Institution of Highway Engineers, with 150 charter members. The objects of the institution are:

(a) To promote the science and art of highway engineering and bridge building, by the holding of meetings, reading of papers and lectures, demonstrations, exhibitions, and any other thing necessary to attain such object.

(b) To establish an examination, based upon the theoretical knowledge and practical experience, necessary to the efficient execution of the duties of a highway engineer.

(c) To represent the interests of all highway engineers in all matters of vital concern, and to make all necessary representations for the protection and advancement of highway engineers and their assistants.

(d) To promote facilities to advance the knowledge of the students of highway engineering, and to urge extension and expansion of existing facilities of training same.

(e) To make such necessary representations from time to time as may be necessary to governmental and local authorities to secure equivalent consideration for highway engineers for appointments, and all such matters concerning same.

H. Slipper, Church st., Stapleford, Cambridge, England, is the secretary.

Road Shoulders and Drains

An Outline of Some of the More Recent Developments in Shoulder and Drainage Work

A STAND of grass affords a most practical and efficient means of protecting and beautifying slopes. This may best be accomplished by seeding or sodding as soon as the new roadbed is finished. Often it is possible in the handling of excavated material to place good soil on the surface of slopes so as to make it easier for seed to take root.

Neat Roadsides.—A method which has proved successful, particularly where planting cannot be done in the spring, is to sow equal parts by weight of rye and a blend of blue grass and clover seed. The rye will grow to a good stand before winter and prevent the washing away of the other seed until it gets started the next year.

Where at all feasible, the whole right-of-way should be mowed and the weeds cut twice a year, in about June and August. One state recently inaugurated the policy of having the highway mowed by contract. It is too early to draw conclusions from this case.

Trees, shrubs and plants which add to the appearance of the roadside should be carefully preserved.

On highways that lead through rolling or hilly country or along streams, it is possible by judicious trimming of underbrush and trees to open up vistas of beautiful scenery and thus add to the pleasure of the traveler.

Well-kept roadsides are more easily maintained than undeveloped ones and not only contribute to the safety and pleasure of the traveling public, but are a distinct advantage to adjoining property.

Roadside improvement is a national movement well under way. Ten states have official highway department beautification and landscape programs financed by public funds. And the work being done along this line, notably in such widely separated states as Massachusetts and California, is meeting with great popular approval.

Old tar barrels whitewashed and marked "Keep the Highway Clean" promote habits of neatness on the part of picnickers.

There should be no advertising signs in the right-of-way and all encroachments, especially lunch stands, open-air markets and gas stations, should be forced completely off.

Better Shoulders.—It is always necessary to have a strip of gravel, stone, or other local material along the edge of hard-surface pavements, otherwise vehicles running off get mired in the soft shoulders. On heavier traveled roads the whole shoulder is given a coat of material and the same maintained by dragging. The paving and oiling of road shoulders is sometimes resorted to where pavements are too narrow and sufficient funds are not available for the widening.

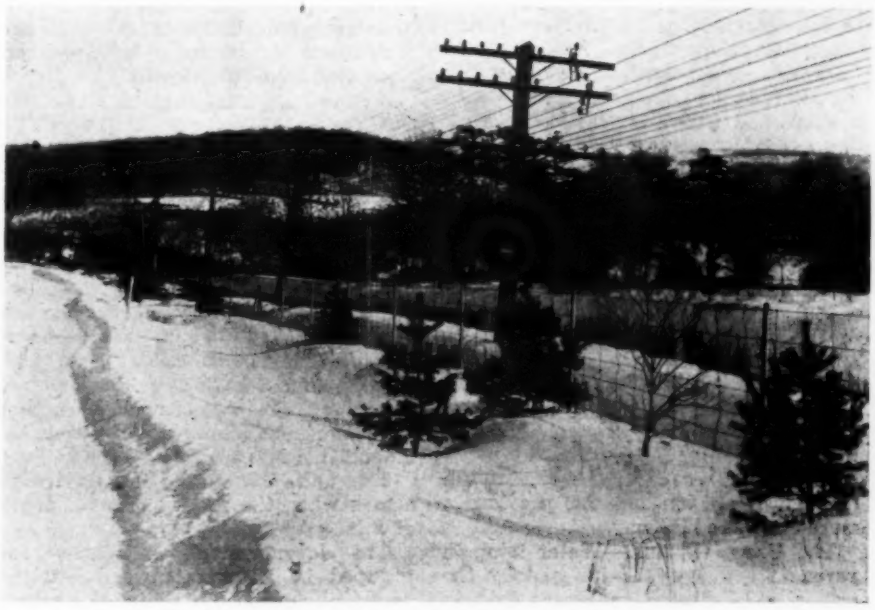
Centerlining of pavements reduces shoulder maintenance. This is a fact because drivers keep nearer the center and more generally on their own side of the road.

One state has tried, with some success, painted lines along the sides as well as the center of the pavement. Such measures pay big dividends in safety on heavily traveled routes.

The road shoulder is being used more today than ever before by passing vehicles. Hence, it is desirable where funds will permit it, to make the shoulders wide enough to park the automobile without it being a source of danger to others. With motor vehicles traveling at higher and higher rates of speed each year, turnouts onto the road shoulder become more frequent. This means that unless the shoulder is at all times in condition to safely carry the vehicle, there is liable to be an accident with serious consequences. So often do we find that old pavements are too narrow. Funds may not be available to widen them. But it may be possible to improve the surface of the road shoulder and alleviate the bad condition. A recent development is the improvement of road shoulders with a traffic bound surface of local or commercial gravel, stone or slag built and maintained by the same methods used in these types of low-cost surfaces. However, the improvement of the road shoulder cannot be expected to adequately handle a situation where the traffic demands a wider pavement.

Stopping Landslides.—One problem confronting the maintenance organizations in most hilly or mountainous sections is that of landslides. These may be divided into three general classifications:

1. Slips moving away from the road which allow the roadbed to settle.



Evergreen Plantings Along a Massachusetts Highway

2. Slips moving towards the road which cover up the roadbed.

3. Slips in which semi-fluid material moves underground and causes the roadbed to heave and buckle.

Slips of the first two types are being successfully stopped by driving piling where the slipping plane is not on rock. When this latter condition prevails, well-casings may be driven into the rock strata. These casings should be reinforced with steel rails or bars and all voids filled with grout after placing. The depth to which these are sunk in the rock should be from one-third to one-half the length of the casing. If the rock slipping plane is too deep to be reached by the well-casing method, or if its angle from the horizontal is too large, the use of dynamite is customary. Well-drill holes should be drilled to a depth of from 10 to 30 ft. into the rock and loaded with enough explosive to thoroughly break up the surface of the rock without removing the overburden upon which the roadbed rests. A heavy charge of explosive is essential in this operation, and more failures occur from underloading than from overloading.

Of recent development in the con-

trol of slips is perforated corrugated pipe, the use of which has proved beneficial in many slips where underground water may be tapped and led away. The control of surface water and the use of cinder fills to lighten the load on the slip wherever practical are also customary practices. It will sometimes be found more economical to bridge a narrow deep slip in preference to attempting a remedy for the slip itself.

The type of slip in which the movement is confined to the underground strata and which causes the surface to buckle and heave is the most difficult to conquer, and in a case of this kind it will often be found advisable to relocate the road to a more stable foundation if possible.

Erosion.—It seems to be generally agreed that road shoulders should have a slope of 1 in. to 1½ in. to the foot, and cut to an elevation slightly below the edge of the pavement.

Open ditches should not have a grade of over 2 per cent. To secure this, weirs of stone, concrete or even wood have been used. These should not be higher than 2 ft.

Paved gutters, pipes laid in the ditch, or a wider pavement with raised curb are means used successfully to handle water coming onto the road and thus prevent erosion of the roadway.

The progressive widening of the roadway and shoulders in maintenance operations takes care of much of the damage of erosion and also provides a more adequate highway.

The Use of Drains.—Water lying in porous strata may be lowered by the use of side ditches or drains laid in trenches. This will help prevent the sliding of side hill fills, it will increase the bearing power of the soil beneath the pavement and mitigate "frost boils." Four-inch drain tile is about the smallest size practical for road conditions and the backfill should be of granular material to give the water better access to the tile.

One case was found where a heavy mole plow pulled with a 10-ton Caterpillar tractor was being used to install French drains in the shoulders and beneath the surface of traffic bound and macadam pavements. It was hoped to reduce materially the cost of this work over hand methods used in the past. The work has not been done long enough to draw any conclusions from it.

Acknowledgment.—The above is an abstract of a report by the Sub-Committee on Shoulders and Drains (H. B. Keasbey, chairman), presented at the recent convention of the American Road Builders' Association.

Snow Fighting in Pennsylvania

Tiny flags and varicolored pins dot a large scale map of Pennsylvania in the office of the equipment engineer at headquaters of the Pennsylvania Department of Highways. The network of highways is divided into sections, in charge of superintendents. In each district flags tell the weather and the forecast for the next 24 hours, so that snow fighting forces may be marshaled and started in a few minutes.

The units have standing orders to attack when the snow reaches a depth of 2 in.

The department's field forces are grouped in 53 maintenance districts, each in charge of a superintendent, whose office is at the equipment storage shed. The shed is simply a garage of special design and construction to house the equipment and facilitate repair. In 92 sheds snow equipment is ready for instant use, while in districts which have the heaviest snowfall each year some units are located at other points, within easy striking distance.

A watchman at each shed notes the first snowflakes and keeps an eye on the depth. Plowmen are warned to be ready for call and at a depth of 1 in. the crews are called out, getting the equipment in readiness. When the snow attains a 2-in. depth the plows start away, each with reserve gasoline, taking up a patrol of highways that lasts until snowfall ceases and every road is cleared and widened out. If winds persist in drifting the plows stay on the job at such points until the drifting stops.

Pavement Roughness Test in Pennsylvania

Concrete highway surface laid in 1929 and tested by the "roughometer" proved smoother, on an average, than any year's record so far made, according to Samuel Eckels, Chief Engineer of the Pennsylvania Department of Highways. Pavement mileage reaching the standard "excellent" in 1929 totalled 276 out of 352 miles tested, a gain in the number of "excellent" miles of 111 per cent over the 1928 record.

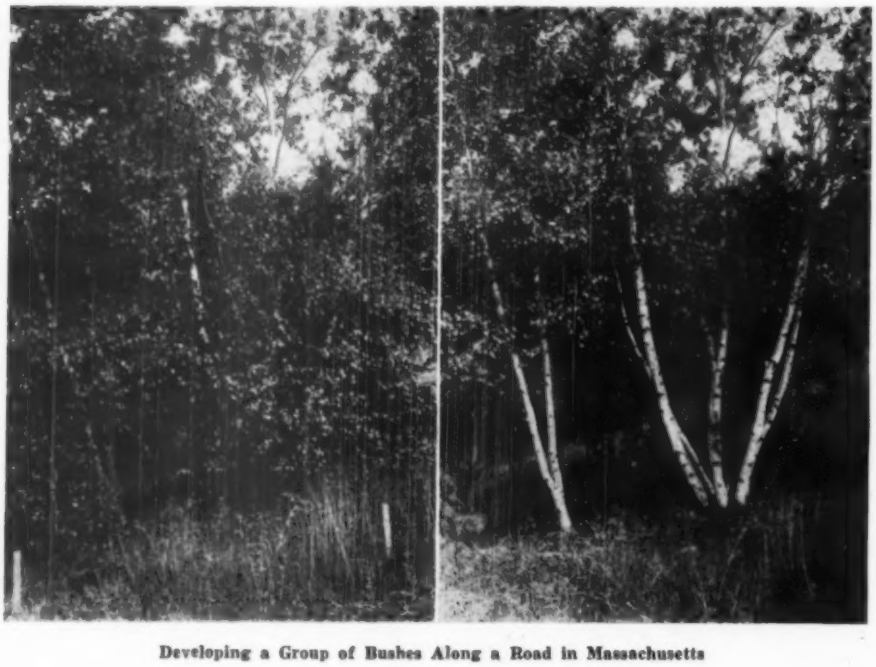
To be classed "excellent" a mile of highway must record on the roughometer not more than 25 accumulated inches or roughness, which shows up on the instrument. In 1928 the meter covered 334 miles of new pavement and indexed 131 miles as excellent, 39 per cent of the total, while in 1929 excellent miles equalled 78 per cent of the total metered.

The grand average of roughness per mile in 1929 was 19.521 in., six less than the requirement for an individual mile of excellent road. This means that many miles were perfect, or nearly so, to hold up the high average. The 1928 average was 30.565 in. or more than five points outside the excellent class.

In 1928 for the first time the figures compiled on quality of riding surface were made known to contractors and department field employes, with special attention invited from inspectors. A keen rivalry resulted, between the eight department divisions and among contractors, each striving to make records for smooth road.

Material Required for Pennsylvania's $75,000,000 Road Program.—It is estimated that the biennial construction program of the Department of Highways of Pennsylvania, embracing the improvement of 1,500 miles of road and the expenditure of $75,000,000, will require construction materials approximately as follows:

Portland Cement, 5,000,000 bbl.
Bituminous Material, 1,000,000 gal.
Crushed Stone, 4,000,000 tons.
Sand, 2,000,000 tons.
Steel, 35,000 tons.
Wire Rope, 4,000,000 ft.
Guard Fence Posts, 400,000.
Guard Fence Fixtures, Castings, Cable Ends, Splices, and so forth, 1,000,000 lb.



Developing a Group of Bushes Along a Road in Massachusetts

Cleaning the Streets and Keeping Them Clean

Deductions Made from a First Hand Survey in More Than One Hundred Cities

By E. PHILIP FREDERICKS
Civic Utilities Corporation of New York

THE past year has seen probably more progress in street cleaning methods than in any former twelve months' period. From coast to coast cities both large and small have been making a determined effort to improve the condition of their streets through the adoption of the latest approved mechanical devices and the elimination, so far as possible, of the antiquated methods so long in use including the "white wings" or hand sweeper who, until very recently, represented the chief method employed by many cities to rid the streets of dirt and refuse.

Progress Has Been Slow.—In connection with this whole subject of street cleaning it is interesting to note that in most cities the street cleaning department has been the one branch of civic activity to show the least progress until recently. In numerous cities, including the largest in the country, the methods employed in cleaning the streets have been very nearly the same as were in vogue 25 years ago. Here and there a city would secure a few mechanical aids, but in very few instances has any effort been made to standardize a new system based on the newest types of equipment. This is all the more remarkable for the reason that mechanical devices are now available that will not only do a better job of cleaning the streets but will do it more quickly and much more economically than under the old order of things.

The reasons for retaining the antiquated methods are, in many cases, not easily reconciled with the facts. The residents and business people in every city are strongly in favor of cleaner streets. Physicians and sanitary experts everywhere are urging the adoption of such methods as will aid in keeping the streets clean and eliminating, so far as may be possible, the dust menace which is responsible for the spread of much disease and the loss of many millions of dollars' worth of merchandise affected by the dust blown into stores and other places of business.

Civic Bodies Protest.—In a number of cities civic bodies have organized to protest against the unclean condition of the streets. In New York City the Committee of Twenty, whose chief activity is directed toward securing cleaner streets, recently held a largely attended mass meeting at which representatives of numerous civic organizations urged the city to adopt improved street cleaning methods. Other cities have followed a similar course and in some instances it has resulted in a reorganization of street cleaning methods and personnel, but a great deal of improvement is still necessary before the average American city will have its street cleaning department on a par with other city departments dealing with civic welfare.

It has been repeatedly claimed, and evidence is not lacking to bear out the claims, that many European cities are much ahead of our own cities in matters pertaining to clean streets. In drawing comparisons, however, it should be remembered that certain underlying factors apply in the case of most foreign cities that do not apply to the same extent on this side of the water. In the first place residents of most foreign countries have for generations been accustomed to obeying the letter as well as the spirit of regulations laid down by the various city administrations. To them a regulation is something to be obeyed and seriously observed. On this side we are often prone to side-step such regulations or ignore them entirely.

The element of civic pride also enters into the subject to no small extent and here again many American cities are lacking in this spirit which, in most foreign countries, is something to be upheld at all costs. To have their city looking clean, attractive and as immaculate as possible is, in many European cities, a matter of deep personal pride and concern with most of the residents. It has also been observed that these same people when they come to this country very quickly fall into the habit, or follow the bad example set by others in this country, of becoming careless and even negligent in matters pertaining to civic pride.

Then, too, the average American city has much more congested traffic to contend with than most European cities. This is partly explained, perhaps, by the fact that one person out of every six in this country owns some kind of a motor car. We can scarcely look for any improvement in this phase of the situation so long as motor cars are being sold at the rate they are in this country.

Effects of Clean-Up Week.—Despite what may look like a rather deplorable case so far as any material progress may be expected in street cleaning efficiency we have ample reason to believe that great advances will be made in this branch of city work in most of the cities and towns throughout the country. This is best evidenced by the awakened interest that is reflected in all sections both through the columns of the papers and the increasing agitation in favor of cleaner streets by the people themselves. The annual Clean-Up Week, which is now observed each year by an increasing number of municipalities, has, among other things, caused people to realize that the streets can be kept clean and that, if to some extent, the same effort that characterizes Clean-Up Week could be perpetuated throughout the year it would result in a great improvement in the appearance and condition of the streets. With this idea once firmly implanted it should not be difficult to keep alive this interest in cleaner streets and the best methods of securing them.

Causes of Present Conditions.—As matters stand the conditions may be briefly sumarized as due to three underlying factors. First, lack of proper cooperation on the part of the general public, who, through carelessness, thoughtlessness or plain indifference, add to the task of keeping the streets clean by the indiscriminate scattering of papers, refuse and odds and ends in the streets and on the sidewalks. People who would hesitate to litter their own premises seem to utterly lack any restraint in littering the streets with anything for which they have no further use.

This very general contribution to refuse and waste matter on the streets aggravates the work of the street cleaning department in practically every city, and if people complain about the condition of the streets they should begin the reform by regulating their own treatment of the thoroughfares. The cities in turn can aid in this work by providing more conveniently located receptacles for waste that is usually tossed into the streets.

Contractors and builders are also responsible for a lot of unnecessary litter that adds to the woes of the street cleaning department. Many retail establishments are also indifferent and careless in properly looking after refuse until such time as it is collected.

A frequent cause of just complaint is the very general system of collecting ashes and garbage in uncovered wagons. There is scarcely a community where this evil is not in evidence and the present methods of such collection are the same, in most cases, as have prevailed for many years. To retain these obsolete methods and to ignore the modern mechanical street cleaning equipment that would go a long way to remedy these evils is on a par with the community that would still retain

gas lamps for street illumination and horse cars for transportation.

The plea is sometimes advanced that a city cannot afford to secure the proper amount of new equipment, yet this claim is really one of false economy because the best of the latest mechanical devices are not only of proven merit and capacity but have shown by repeated tests that they soon pay for themselves and can do more and better work and do it more quickly than is possible through the employment of the old methods. It would, as a matter of fact, be a good investment for any community to equip itself with all the best mechanical equipment that it can use. The difference that would result in both the appearance and sanitary condition of the streets would amply repay the change of policy. Clean streets tend to make a clean city, and a clean city not only attracts people but aids in increasing property values and community welfare. The plea, therefore, that a city cannot afford new equipment is a fallacy; the fact is that no city can afford to be without the most modern type of street cleaning equipment.

Cooperation of Police Department Effective.—A leading factor, as well as a helpful one in a number of cities, is the cooperation given by the police department in facilitating the work of the street cleaning department. A concrete example of this is shown in the case of Washington, D. C. In that city there is a splendid coordination of effort between the two departments. It results, among other things, in a well-defined system whereby the alternate sides of each street are, one after the other, kept entirely clear of parked cars during specified hours. This enables the street cleaners to work unhampered and they can naturally do a much better job than in cities where no such cooperation exists.

A survey in more than one hundred cities shows that unlimited or unregulated parking is a great handicap in the proper cleaning of the streets. If cities would put into effect a working agreement between the street cleaning and the police departments, along the lines of the Washington plan, there is no doubt that much improvement over the existing conditions would result.

Under the head of dry sweeping may be listed the work of the "white wings" or hand sweepers, and the rotary brush, either horse drawn or motor driven. These two methods are still in almost general use in most cities, including our largest centers of population. Inquiry has revealed that so far as the hand sweepers are concerned they are retained in a number of cities largely as a sort of municipal employment bureau for men who find it difficult to secure any other kind of work. In some cities it is used as a very potent phase of the political patronage that is handed out regardless of who is in power in the city administration. Some street commissioners frankly admit this and confess that they are powerless to alter what has become a fixed custom.

So strongly has this element of patronage become entrenched in some sections that in at least four cities it has been found necessary to post guards over labor-saving devices in order to prevent sabotage. It appears certain that this attempt to retard progress in any branch of city work must and will be eliminated as the growing needs of a city demand the newer and better ways of doing things.

Bringing the matter of street cleaning right up to the advent of 1930 we find that a number of the leading cities in this country and abroad have adopted a system of vacuum street sweeping which has solved a number of the problems that have heretofore slowed up the work of the street cleaning department. The advantages claimed for this method of cleaning the streets are much the same as those which have caused the almost universal adoption of vacuum cleaning in the home and in many business places. The sanitary feature alone is an important one, as this new method removes not only all the dust and finer particles of dirt but the heavier litter as well. This, of course, eliminates the source of much contagion and the menace and annoyance of dust filled air. Great areas can be thoroughly cleaned by the vacuum in one single operation in a very short time.

Dustless ash removers are also being perfected to a point where this evil is no longer necessary and as fast as cities enforce the rule providing for covered garbage receptacles there will be a proportionate reduction in the present objectionable methods of handling such refuse in most of our cities and towns.

To summarize the street cleaning situation in a nation-wide view we find that three outstanding factors will enable most cities to have cleaner streets and be able to accomplish this result with less effort and at a lower cost. These three essentials are: First—Educating the general public to cooperate with the street cleaning department by helping to keep the streets and sidewalks clear of unnecessary litter. Second—Cooperation of the Police and Health Departments in regulating parking and enforcing sanitary codes. Third—The adoption of the latest and best mechanical equipment to replace the antiquated equipment and obsolete methods now generally employed.

Traffic Passing by or Through

The conviction that arterial highway traffic should flow around and not through towns and cities is reported to be growing by the Transportation Department of the Chamber of Commerce of the United States. Municipalities are beginning to realize that the cost in clogged streets and congested traffic is greater than any advantage derived from routing through traffic through them.

"While a few years ago the business interests in municipalities of all sizes appeared to think it desirable to have major highway routes pass through their principal streets," says the department in reply to an inquiry, "they have in recent years come to believe that it is preferable to route this through traffic around the congested business districts, with signs indicating clearly to passing motorists the way to get to the business centers if they desire. In other words, they appear to believe now that where through traffic goes through the principal streets, a large part of it has no other interest than to get through as quickly as possible, and is, perhaps, irritated and deterred from stopping to make purchases by the congestion, rather than encouraged to do so, and that this traffic in turn interferes with the local business of the community."

"Cafeteria" Traffic Courts

Motorists guilty of minor traffic law violations are not criminal offenders and their cases should be diverted from overcrowded courts which are already the weakest link in the machinery of traffic law enforcement, according to Miller McClintock, Director of the Erskine Bureau for Street Traffic Research.

In a report to the Massachusetts Department of Public Works, McClintock advocates the establishment of "cafeteria traffic courts" or fines bureaus which automatically fix penalties and collect fines for minor offenses without the usual court formalities. These bureaus rapidly dispose of the bulk of cases which normally congest the courts, leaving the latter free to take more effective action on serious offenses.

The "cafeteria court" plan originated in Detroit and has been successfully adopted in several other large cities, including Chicago and San Francisco. The plan gives motorists the option of waiving trial and paying the standard fine for the offense, or demanding court trial. Unless the driver demands a court trial payment can be made to a court clerk without delay. If the offense is serious or if records show the driver to be a habitual offender, formal court procedure is mandatory.

Highway Maintenance in Massachusetts

How One of the Oldest State Highway Systems in the Country Is Maintained

A COMPREHENSIVE account of the highway system of Massachusetts from its inception in 1893 to the end of 1928 is given by Arthur W. Dean, Chief Engineer, Massachusetts Department of Public Works, in the December Journal of the Boston Society of Civil Engineers. The following notes regarding maintenance are taken from this article.

The work is carried out under the direction of the maintenance engineer of the Department of Public Works, who directs the work through a permanent maintenance organization in each district in charge of a maintenance foreman, the numbers of workmen varying upwards to a maximum of 60 men per district in the summer season.

Safety, of course, is one of the prime objectives of the maintenance work, followed by the consideration of utility and sightliness.

All surfaces, therefore, are kept in a safe condition by constant inspection, and locating points where repairs are necessary, and early attention is given to incipient breaks or to any indication of disintegration.

Maintenance of Older Type Surfaces.—The older types of surface, namely, the waterbound macadam and gravel, are given surface treatments of 1/5 gal. per square yard of hot asphaltic oil or of tar as required, generally once in from two to five years. Careful paint patching with the same material, from time to time, generally prevents the formation of any holes.

The last of the dirt surface type of state highway has been wholly reconstructed and replaced by bituminous macadam during the last two years. This is on the Mohawk Trail.

The more modern types of surfaces, such as bituminous concrete, bituminous macadam and cement concrete, require more individual care.

Maintenance of Bituminous Concrete.—Bituminous concrete of the usual high type requires but little attention. If holes do develop it is generally because of subgrade failure, in which case the defect is corrected and the surface restored.

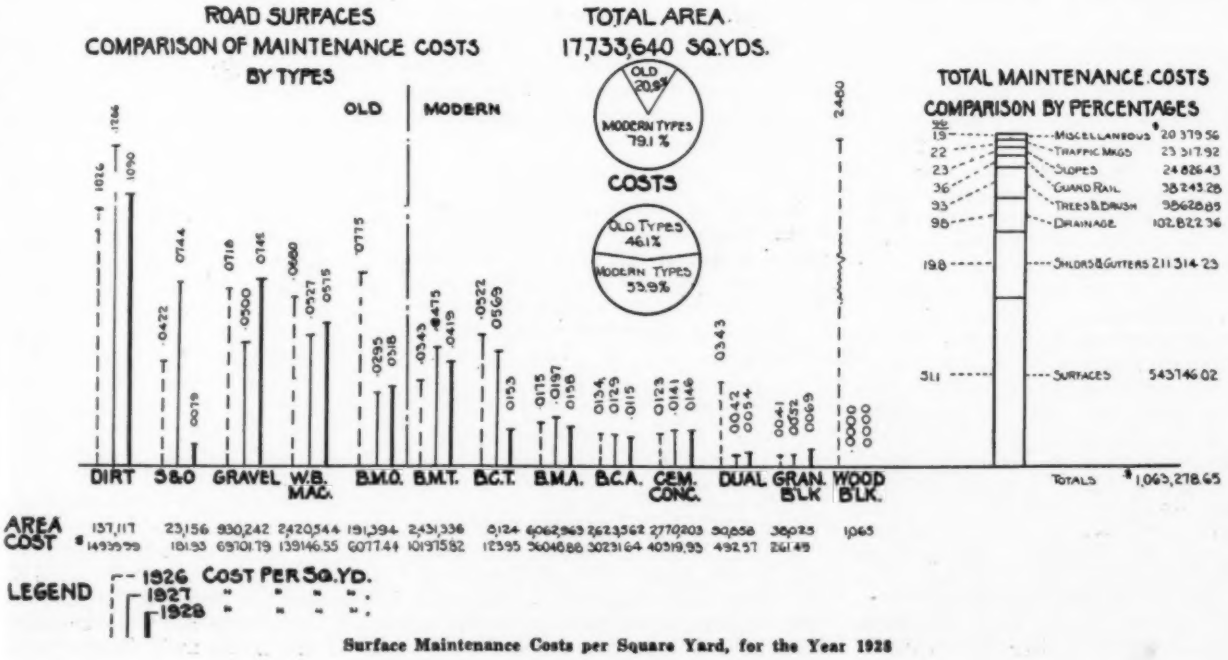
The type of bituminous concrete constructed on Cape Cod is rarely in need of surface treatment, but it is essential that the seal coat be kept intact. This is done by paint patching as required. When such a surface is in need of an application of bituminous material, hot asphaltic oil is used at the rate of 1/5 gal. per square yard and heavily sanded.

Maintenance of Bituminous Macadam.—A bituminous macadam surface of trap rock, penetrated with a good grade of bituminous material, laid on a well-drained roadbed of proper width and thickness, requires practically no maintenance. Some of the older bituminous macadams, however, contain a large percentage of local stone, which is soft, and furthermore, they are not thick enough, or are over subgrades that are not well drained.

Surfaces composed of local stone fail because of the disintegration of the individual stones, thus permitting the entrance of water and frost that will eventually disrupt the entire surface. This condition is easily discerned, however, and corrected with a seal coat of either hot asphaltic oil or penetration asphalt.

Defects caused by lack of strength, due to insufficient thickness, and by subgrade failures are corrected by scarifying the old surface, adding fresh stone to obtain the required strength and thickness, rolling, binding with sand or stone screenings, and establishing a bituminous pavement by the application of two treatments of cold tar (⅜ gal. per square yard) with the sanding and rolling of each application. The following year a heavier bodied asphaltic oil is applied. Some work has been done using asphalt emulsion to penetrate a surface that has been scarified and shaped, adding fresh stone as required, and rolled. The results are satisfactory, and there is little question but that the use of asphalt emulsion to penetrate a scarified surface will become more general.

Maintenance of Cement Concrete.—While cement concrete surfaces, on the whole, require but little maintenance, that little is hard to give. Joints and cracks are kept filled, being poured twice a year, in the spring and again in the fall. Asphalts and tars are each used for this. Surfaces which have scaled are paint patched, using a bituminous patching compound, or 85 per cent asphaltic oil, and sanded. Surfaces which are disintegrating too extensively, or have become too unsightly because of the number of cracks and bituminous patches, are given a surface application of 1/5 gal. per square yard of 85 per cent asphaltic oil or hot light tar and covered with a mixture of stone



Surface Maintenance Costs per Square Yard, for the Year 1928

chips and sand. During the past season considerable use has been made of asphalt emulsion for the surface treatment of cement concrete surfaces. The emulsion is applied at the rate of ⅛ gal. per square yard from an air pressure distributor, and covered, first with ⅜-in. stone chips and then with a well-graded sand. The presence of water in the emulsion delays the setting up long enough to permit of maximum penetration by the mineral aggregate. Applying the sand before the chips assures of full penetration of the chips. It is considered essential to use sand with the chips in order to form a matrix that will more positively hold the chips in place.

Other Features of Maintenance Work.—The shoulders adjacent to all types of surfaces must be kept in such condition that they will not only make possible the proper disposal of surface water, but shall be safe at all times. In the spring gravel is added when the shoulders are low, and those which are higher than the surface are scraped with a road machine. During the rest of the season they are kept in condition by dragging once or twice a week. It is found that such maintenance likewise protects the edge of the macadam and bituminous concrete surfaces. It is interesting to note that the care and upkeep afforded the shoulders of cement concrete surface costs almost as much as the care and repair of the surface itself.

Catch basins, culverts, ditches, etc., are cleaned out during the fall and as often during other periods of the year as required. Additional drainage systems are frequently installed to provide outlets where water gathers. Side drains are installed wherever subgrade defects are corrected.

All guard rail, both the old wooden type and the new cable type with cement concrete posts, is painted at least once in two years, repaired promptly when broken, and kept at all times in a presentable condition.

The care given to the roadsides has come to have a larger significance than was the case a few years ago. Today, not only are the roadsides mowed, but they are mowed with intelligent care, in order that sightly clumps of flowering and other shrubs may be spared to add to the beauty that the department is endeavoring to develop in the roadsides. An effort is being made to properly care for all existing trees and shrubs, and to plant others where needed; to open up vistas by judicious trimming, and to make the entire layout clean, sightly and beautiful. The major part of the work, such as the trimming of grass, weeds and brush, the removal of dead limbs and trees and the routine planting, is done by the maintenance forces of the districts. The work as a whole is under the direction of a highway landscape supervisor. Connected with this work there are three nurseries which contain all types of trees and shrubs that are considered suitable for planting on the roadsides of Massachusetts. For carrying out this work there is a corps of trained men, who perform all the work of a more scientific nature in tree repair and surgery, and in the carrying out of the plainting program.

Highway Grade Crossing Elimination

Declaring that danger to life at grade crossings is three and one-half times greater than in other parts of the highway system, Morris Goodkind of Trenton, N. J., bridge engineer of the New Jersey Highway Commission, in his report as chairman of the American Road Builders' Association committee on grade crossings, recommended that every economy in design and construction be used in order to permit the maximum number of grade crossing eliminations with the funds available for this purpose. The report was submitted Jan. 16 at the 27th annual convention of the American Road Builders' Association.

The following five recommendations as a means of meeting the serious grade crossing problem were presented by the grade crossing committee which, in addition to Goodkind, includes William L. Craven, Bridge Engineer, North Carolina State Highway Commission; C. C. McCullough, Bridge Engineer, Oregon State Highway Commission; S. B. Slack, Bridge Engineer, Georgia State Highway Commission:

1. A definite classification of crossings based on the relative value to the travelling public of their elimination.

2. A definite annual program by each state and each of the railroads in each state for the elimination of grade crossings of the highest classification.

3. Restriction of the authority to create grade crossings.

4. A definite progressive program in each state for installing safety warning devices of a rigidly standardized type or types.

Equipment for Garage of County Road Department.—In a report presented at the recent convention of the American Road Builders' Association, Mr. J. F. Coleman of Georgia recommended this equipment for a county garage:

1. Burning in stand (for light motors).
2. Two spindle motor-driven drill presses.
3. Air compressor.
4. Every wheel and brush (motor driven).
5. Paint spraying outfit.
6. Cylinder hone (motor driven).
7. Electric drill.
8. Blacksmith's forge and anvil.
9. All necessary small tools and equipment.

He stated that no county that owns only a few pieces of equipment is so poor that, as a matter of good business, it should not provide a shop of some kind with a good mechanic.

City Planning Commissions in 691 Municipalities

The growing interest in city planning and its widespread development throughout the United States is again shown by a survey recently completed by the Division of Building and Housing, United States Department of Commerce.

A tabulation made from returns to questionnaires sent to various cities, towns and villages in the United States shows that at least 691 of these municipalities have official planning boards or commissions in existence. Of this number, 208 are cities having in 1920 a population of over 25,000, comprising more than two-thirds of all the cities in that population group. The other 483 vary in size down to villages of less than 1,000, and several of the smallest of these have less than 500 inhabitants.

The large number of municipalities of all sizes which at this time have planning commissions, and the fact that the interest in planning activity is not confined to any one region of the country, indicate a general appreciation of the need for modern city planning, according to the department.

The tabulation, in addition to summarizing the total number of planning commissions now in existence, groups them according to states, presents data as to the number of members of each commission, the number appointed and the number serving as ex-officio members, the terms of office and the titles of the executive officers. It also indicates which of these cities have zoning ordinances in effect.

Traffic Fatalities

The need of more effective control of highway traffic, which took a toll of more than 31,000 lives in the United States in 1929, is strikingly reflected in figures compiled for the National Conference on Street and Highway Safety. These show a constant decrease in the fatality rate in relation to registration from 1913 down to 1924 but, apparently, with the latter year the rate again began to mount upward.

The number of fatalities per 1,000 cars registered, exclusive of deaths in railroad crossing accidents and street car collisions, in 1913 was 1.99. For the following years the record was: 1914, 1.65; 1915, 1.63; 1916, 1.48; 1917, 1.26; 1918, 1.22; 1919, 1.05; 1920, 0.99; 1921, 0.975; 1922, 0.955; 1923, 0.955; 1924, 0.88. In 1925 the rate went up to 0.885, in 1926, down to 0.86, the lowest point reached; in 1927, to .918; and in 1928, to 97.2.

Studies in progress indicate that this latter increase is due to the fact that in some states regulation has not kept pace with registration. In states where measures recommended by the Conference have been adopted the improvement has, in the main, been continuous.

Present Day Traffic Problems

Creation of Arterial Highways—Segregation of Types of Traffic—Traffic Volume and Loads —Classification of Highways on Basis of Vehicle Load

THE creation of arterial highways, if properly done, is one of the best means of expediting the movement of motor vehicle traffic. Such highways provide for the continuous flow of large volumes of traffic at a more rapid speed than is normally possible on existing streets where there are frequent intersections and other obstacles to the free movement of traffic. They can be created either by the establishment of an existing road or street as an arterial highway or by the construction of an entirely new road or street.

Designating Arterial Highways.—In any area which includes a large city as its center of population and industry the main flow of traffic is between the central district of this city and the principal surrounding suburbs and sub-centers of population. The principal connecting highways should be designated as arterial highways and the traffic entering them from intersecting routes be compelled to stop before it enters the stream of traffic on the main highway.

Since the purpose of the arterial highway is to provide for the maximum continuous flow of traffic it is essential that obstacles to this rapid and continuous movement be removed and prohibited. Traffic lights, for instance, erected on an arterial highway at the intersection of an important belt or lateral route obviously retard traffic on the arterial highway. In many cases, investigation will show that it is cheaper to construct grade separations at such important intersections or pedestrian subways at others where safe crossings for pedestrians must be provided.

The principle of arterial highways applies not only in the rural areas but in suburban and urban areas as well. It is only logical, however, that as the central city becomes nearer and its influence greater, the number of radiating arterial highways is increased and a point is finally reached within the central business district where traffic signal lights or other control methods must take the place of the arterial highway "Stop" sign. The cities should, however, guard against setting up a too elaborate system of arterial streets. An unnecessary number of streets so designated involves constant stopping and starting of cross streams of traffic and eventually results in provoking carelessness and lack of obedience to "Stop" signs.

Arterial Highways Speed Up Traffic.—A limited number of arterial highways carefully selected to serve large volumes of traffic between the heart of the central city and its surrounding territory, together with adequate police enforcement and educational work on the part of safety councils and other civic organizations is one of the chief methods which can be employed to speed up traffic on city streets. Large sums of money can thus be saved by the full utilization of certain main streets not only by avoiding costly improvement projects but also in savings to motor vehicle operators by decreasing traffic delays.

Where existing roads and streets cannot satisfactorily be designated as arterial highways it is necessary to provide new thoroughfares by the purchase of partial or entirely new right-of-way. This is true when street car tracks are located on present streets and the cost of widening is prohibitive or when these streets do not afford a direct route for a large part of the traffic from point of origin to point of destination. Traffic studies have indicated in some cases that as much as 50 per cent of the traffic between certain sections of an area is using indirect routes because of the lack of a direct connection or because of congestion on the direct routes. When new highways are contemplated careful surveys should be made to indicate the general lines in which traffic wants to move and the locations which will serve as direct routes for the greatest amounts of traffic.

It is recommended that uniform wording be adopted for use on "Stop" signs erected at the entrances to arterial highways. Such signs now carry a wide variety of terms, including: arterial highway, boulevard, main road, main thoroughfare, etc. The words "arterial highway" are most commonly used and best express the intended meaning. All traffic should be required to stop before entering an arterial highway.

Segregation of Types of Traffic.—The segregation of passenger car and motor truck traffic is another method of increasing traffic speed on congested thoroughfares. To accomplish this, certain streets are reserved for passenger car traffic only. At the same time, however, it is also necessary to provide properly designed streets of adequate width to serve motor truck traffic, since both types of traffic are equally important. The designation of passenger car boulevards is most effective in the case of routes serving highly developed residential areas where the proportion of automobile ownership is high.

Around the large cities, there are highly developed residential areas in one or more directions. A special route, set aside for passenger car traffic only, connecting each of these sections with the central city will go far toward increasing traffic speed and relieving traffic congestion. These special boulevards, however, should be free from the customary obstacles to free-moving traffic, such as street car lines, railroad grade crossings, sharp curves and steep grades. Motor trucks compelled to use parts of such boulevards in order to

Planting to Soften Harsh Lines of Protective Stones on a Massachusetts Road

A Riverside Road in Massachusetts

make deliveries should enter and leave by the nearest cross street.

The effectiveness of such boulevard highways is illustrated by two arterial streets between the center of Cleveland and the adjacent city of Lakewood. On one of these routes which is reserved for passenger car traffic only the average daily traffic of over 35,000 cars travels at approximately 30 miles per hour. On the other route, on which the traffic is 12,000 vehicles per day, including all types of motor vehicle traffic and also street car traffic, passenger car traffic travels at approximately 13 miles per hour.

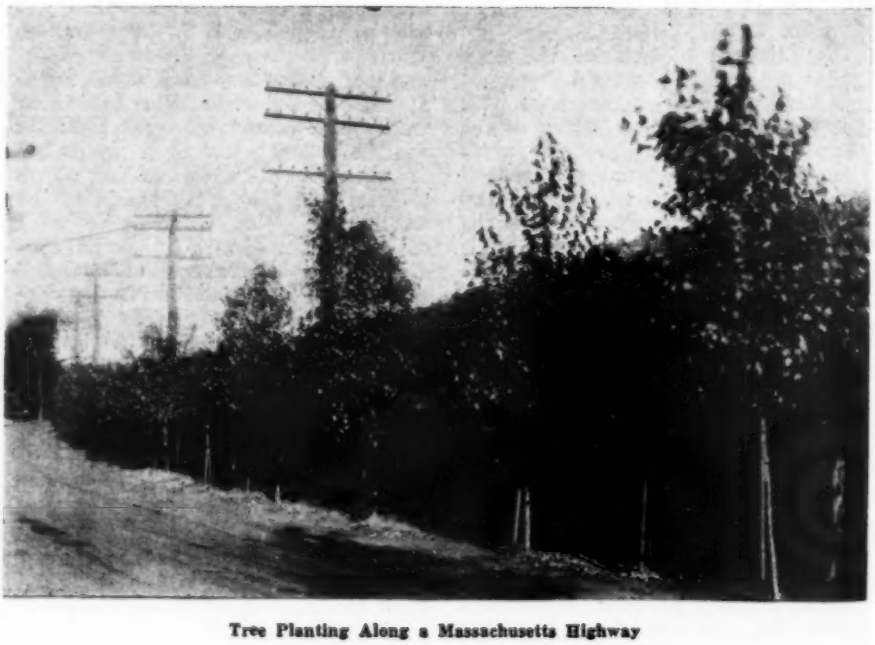
The principle of motor vehicle traffic segregation is the same as that practiced by our main rail lines between large centers of population. Separate tracks are provided for the use of express trains, and for local passenger and freight service. The ultimate development in our highway systems will be the construction of multiple-lane arterial highways with separate lanes for fast and slow-moving traffic or the construction of parallel routes in cases where the cost of extensive widening is prohibitive and the problems of distribution preclude the concentration of large volumes of traffic on one main road. Such developments are gradually taking place in some of the heavy traffic areas, but in general they will be delayed until the volume of traffic justifies the expenditures necessary for the construction of such routes.

Traffic Volumes and Loads.—Although considerable evidence has been collected from time to time regarding the volume, loads and tire equipment of motor vehicle traffic on urban and rural highways, very little progress has been made toward the practical application of this evidence to the design and type of highway pavements. General practice and trends in motor truck loading and equipment can be stated on the basis of available evidence, but until these facts are correlated with pavement type and design by our research and test engineers, it is impossible to construct pavements economically and in accordance with the volume and type of traffic.

It is a fallacy to assume that motor truck traffic occurs in great volumes on all our streets and highways, or that the proportion of heavy trucks is constant. The location and size of cities and towns determine to a great extent the volume of motor trucking on various highways of a state. Centers of population and industry are the main source and destination of goods transported by motor truck. As the source of truck traffic, they are the distributing centers for surrounding territory and the origin of goods for movement to other cities situated within an economical truck-haul distance. They form the destination for direct-consumption goods from farms and for raw material to be converted into finished products for local use or reshipment.

Traffic studies made in a number of states and regional areas have shown that the traffic of large-capacity trucks, and consequently of heavy loads in appreciable volumes, is largely limited to the vicinity of the large centers of population and industry. This is true of main-line roads as well as secondary and third-class roads. Great numbers of heavy loads occur on main rural highways only when such highways connect important cities or villages located within a short-haul zone. The absence of heavy loads upon the major portion of rural highway mileage makes it possible for the highway engineer to provide pavements designed to carry fairly definite volumes and loads.

Since truck traffic in large numbers is concentrated in and around the larger cities, it is in these areas that the problem of standardizing pavement design to meet various load requirements is most difficult. It is known from traffic surveys made in the vicinity of large cities that the volume of total truck traffic and of large-capacity trucks decreases very markedly with increasing distance from the central city. Such studies made on the principal routes radiating from the center of Cleveland have shown that the percentage of trucks of 5-ton or more capacity decreases from 11 per cent at the city line to 5 per cent at a distance of five miles beyond the city line and to 3 per cent at ten miles beyond the city line. It was also found that 80 per cent of the trucks on the main highways of the Cleveland Re-



Tree Planting Along a Massachusetts Highway

gional Area are of less than three-ton capacity and that 85 per cent of these smaller trucks are equipped with pneumatic tires. Of the trucks with a capacity of three tons or more, 15 per cent operate on pneumatic tires. The same general conditions have been observed in a large number of other areas with the trucks of less than 3-ton capacity ranging from 80 to 95 per cent of all truck traffic.

A large share of our heavy truck loads today are composed of loads of building and road-construction materials. This is particularly true in cities and surrounding territory. In the Cleveland area 36 per cent of the trucks equipped with solid or cushion rear tires haul sand, stone, brick, cement, slag, and other similar materials. The average gross weight of these trucks is over 21,000 lb. as compared with an average of 14,000 lb. for trucks equipped with the same type of rear tires, but hauling other commodities. Excessive loads of construction materials should be prohibited, especially on medium and minor type roads and streets used temporarily during the construction of a particular project.

General observation of motor truck traffic indicates a trend toward the smaller size, speedier truck and the increasing use of pneumatic tires for large trucks.

Highway Classification.—The restriction of heavy truck loads on rural highways is not a new idea. It has been practiced by states and counties, particularly in the winter and spring months, for the purpose of preserving existing roadway surfaces and for public safety on bridges of limited load capacity. However, the actual construction of roads to certain standards with the idea of restricting vehicle loads in accordance with design is not a general practice. Vast sums of money could be saved each year by a system of highway classification. Overdesigning for light traffic routes is just as uneconomical as under-designing for heavy traffic routes. Traffic studies readily indicate the roads on which heavy truck loads occur infrequently, and such loads can be prohibited without inconvenience once the principle of classification and its usefulness have been established. In cities, however, this procedure becomes more difficult due to the concentration of large trucks with their heavy loads in these areas, but even in the cities there are certain sections in which motor truck traffic is heaviest. This is true of terminal districts, sections which include supply yards and industrial areas. The amount of motor truck traffic is also concentrated on certain streets; it may average as high as 3,000 or 4,000 trucks a day on a few streets to as low as 100 trucks a day on a large number of streets in the same area.

The soundness and economy of street and highway classification on the basis of the volume and type traffic and maximum loads are obvious. The full benefit of such classification cannot be realized until sufficient evidence has been produced to determine definitely what design is necessary, and what types of pavement are required for given traffic volumes and loads. Continued and more comprehensive research in this field is recommended as essential to the economic development of adequate highway systems.

Acknowledgment.—The foregoing is a report of the A. R. B. A. Committee on Traffic, City Official Division, presented at the recent convention of the American Road Builders Association.

Calcium Chloride as Preventative of Slipperiness on Icy Roads

Otto S. Hess, Engineer-Manager of the Kent County, Michigan, Road Commission, in a letter to B. C. Tiney, Maintenance Engineer of the State Highway Department of Michigan, which is reprinted in "Michigan Roads," states that very satisfactory results have been obtained from the use of calcium chloride, mixed with sand or gravel to relieve slippery conditions on icy roads.

Mr. Hess states that best results have been obtained in Kent County by the following procedure:

"First, spread the calcium chloride on the icy surface by using a spreader hooked behind a truck in the usual manner. The spreader should be set for spreading the smallest amount and the truck should be driven at a speed of 15 to 20 miles per hour. This will scatter the material on the surface of the road in sufficient quantity to obtain satisfactory results, and will only require about 300 lb. per mile, assuming that the work is carried out on the middle of the road only. The calcium chloride and sand is sufficiently scattered by traffic, so that an application on the middle of the road is ample. This should be followed with an application of sand distributed either with the use of a sand spreader or from a regular dump truck operated at a rather high speed. If the sand is cold and contains more or less frozen lumps, the sand spreader should be used. If warm sand is available just as good results as to spreading can be obtained by spreading directly from the truck.

"We find that the minimum amount of sand which we think satisfactorily spreads and which will do the business properly is about 2½ cu. yd. per mile. We also find that it takes just about six minutes to apply this sand on a mile of road.

"With reference to the matter of sealed concrete due to the use of calcium chloride in sand, I wish to say that we have not noticed any places in this county where such scaling has occurred."

Traffic Engineers Needed by Cities

Evidence to show that traffic engineering is a big factor in control of accidents is presented by William S. Canning, engineering director of the Keystone Automobile Club and a member of the Street and Highway Section of the National Safety Council, according to "Public Safety." The figures are from Department of Commerce highway fatality records.

Cities with traffic engineers more than hold their own against the nationwide increase in fatalities, according to Canning's figures. He arrived at his conclusions by grouping fourteen of the leading cities, and separating them into two classes—one with traffic engineers and the other without.

Department of Commerce figures, he said, showed that Chicago, Detroit, St. Louis, Boston, Newark, Pittsburgh and Washington, as a group, had a total of 1,713 traffic fatalities in the year's period ending Nov. 30, as against 1,715 fatalities in the same period last year.

The other group, without traffic engineers, showed an increase in fatalities of 23 per cent. In this group are New York, Philadelphia, Cleveland, Baltimore, Camden, Paterson and Trenton. The fatalities numbered 2,218 as against 1,804 last year.

Cities Having Traffic Engineers

	Fatalities 1928	1929
Chicago	813	776
Detroit (1)	291	356
St. Louis	170	154
Boston	120	117
Newark (2)	104	105
Pittsburgh	134	131
Washington	83	74
Totals	1,715	1,713

Cities Without Traffic Engineers

	Fatalities 1928	1929
New York	1,040	1,291
Philadelphia	326	413
Cleveland	237	280
Baltimore	117	141
Camden	33	43
Paterson	30	36
Trenton	21	14
Totals	1,804	2,218

(1) Detroit was without a Traffic Engineer for over a year, but just re-employed one during 1929.

(2) Traffic Engineer of Essex Co. serves in advisory capacity for City of Newark.

Printed Booklet on Revised Simplified Practice Recommendation on Paving Brick Now Available.—It has just been announced by the Division of Simplified Practice, of the Bureau of Standards, Department of Commerce, that the printed booklet on Simplified Practice Recommendation No. 1—Paving Brick (Seventh Edition), is now available. An examination of this booklet, copies of which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 ct. a copy, discloses that the simplification program for this product has effected a reduction of variety from 66 sizes and types to 5 or approximately 92 per cent.

Street Traffic Signs

Recommended Practice Given in the Report of the American Engineering Council's Committee on Street Traffic Signs, Signals and Markings

THE work of the National Conference on Street and Highway Safety showed that a valuable public service could be rendered by the establishment of greater uniformity in the use of street traffic signs, signals and markings. The American Engineering Council, a body participating in the conference, offered to make a national survey of the existing conditions and to prepare a recommended practice. The offer was accepted and the council then appointed a Committee on Street Traffic Signs, Signals and Markings. Surveys were made in 35 states, and returns were collected from over 100 cities having a population of more than 33,000,000. It is believed the returns cover all conditions and methods of traffic control. The report of the committee was issued last year and from it we are taking that portion relating to street traffic signs.

Adequate signs are great aids to the drivers of vehicles and are therefore important means of safeguarding and expediting traffic. To be adequate every traffic sign should be so thoughtfully designed and so carefully placed as to convey its message quickly and clearly at the exact time and place it is needed. These requirements mean simple wording; standard shape, color, lettering, and location; announcement of the official authority if that is legally required; and the removal of every unofficial sign that in any way conflicts with the requirements. No matter how effectively traffic signs may be designed and placed, the results desired will not be realized until the messages conveyed are carefully observed by drivers and the regulations implied are zealously enforced. With these facts in mind the committee has formulated and here submits some basic essential recommendations concerning the design, location, and use of street traffic signs.

Fig. 1—Stop Sign—Through Traffic Street, Letters and Border, Solid Red, Background, Federal Yellow

(*See Recommendations* 10-15)

(Note: When a sign 24 in. by 24 in., as provided in Recommendation 10-a, is used the word "Stop" shall be in 6-in. Series E letters, and the message words in 3-in. Series B letters.)

Recommendation 1. — Material and Finish.

(a) Select sign material and finish first for durability, second for economy.

Fig. 2—Slow Sign—Safety Zone, Letters, Arrow and Border, Solid Black, Background, Federal Yellow

(*See Recommendations* 16-18)

(b) Use cast metal (either iron or aluminum), sheet metal (either steel or aluminum), or wood; here named in the order of preference.

(c) For all signs use the specifications proposed by the Joint Board on Interstate Highways of the Bureau of Public Roads, the American Association of State Highway Officials, and the United States Bureau of Standards.

Recommendation 2.—Shapes and Dimensions.

The following shapes shall be used for the purposes indicated:

Railroad Crossing.....Cross Buck
Railroad Crossing Approach.....Circular
Stop .....Octagonal
Slow .....Diamond
Caution .....Square
One Way and Detour.....
.....Arrow, or Arrow on Rectangle
Information .....Rectangular
Restriction .....Rectangular

All signs should be made in the dimensions hereafter specified if possible, but existing equipment that varies somewhat from the specifications may be used provided the general proportions are the same. Most of these dimensions are smaller than those given in the code of the American Association of State Highway Officials, because vehicles generally move slower in city traffic than on rural highways, and signs may be seen at shorter distances in cities; also because smaller signs occupy less space and do not seriously interfere with the vision of pedestrians if placed below their average height.

Recommendation 3.—Colors.

The combination of colors here specified shall be used for the purposes indicated:

Railroad Crossing.....
....Black letters on white background
Railroad Crossing Approach.....
....Black letters on yellow background
Stop .....
.....Red letters on yellow background
Slow .....
Black letters on yellow background
Caution .....
Black letters on yellow background
One Way and Detour.....
.....Black letters on white arrow
Information .....
....Black letters on white background
No Parking.....
.....Red letters on white background
Limited Time Parking.....
....Green letters on white background
Pedestrian Restriction .....
.....Blue letters on white background
Other Restrictions.....
....Black letters on white background

The colors recommended above for Stop signs combine a yellow background with red for the word "Stop," in conformity with the generally recognized meaning of that color in traffic control devices of other types. This combination avoids the disadvantages of black letters on a yellow background, recommended by the Joint Board of Interstate Highways, in which the black letters cannot be made luminous at night, a disadvantage that has led to the modification of the sign by the introduction of a black band across the sign on which is imposed the word "Stop" in white letters, making a three-color combination.

The stop sign recommended above also avoids the disadvantages of white letters on a red background, proposed by the Traffic Signal Color Code Committee, in which the red background is

Fig. 3—Slow Sign—Cross Street, Letter, Border and Cross, Solid Black, Background, Federal Yellow

(*See Recommendation* 19)

Fig. 4—Slow Sign—Hill, Letters and Border, Solid Black, Background, Federal Yellow
(*See Recommendation* 20)

not clearly visible at night and the letters if illuminated appear white instead of red.

Recommendation 4.—Lettering and Wording.

The lettering, wording, and arrangement here specified shall be used for each type of traffic sign, but symbols may be added or equivalent words may be substituted if the standard size and arrangement are maintained. Suitable wording in small letters expressing local authority shall be placed on the bottom of all signs when specified by law or regulation.

Recommendation 5.—Illumination.

All important traffic signs shall be clearly visible day and night. Signs that affect the safety of night driving should be adequately illuminated. Certain important directional signs that are intended primarily to facilitate traffic may be illuminated at night. In this report signs that require illumination at night are specially mentioned. This illumination shall be provided by one of the methods listed below, named in the order of preference:

(a) Attached lamps flooding the face of the sign.

(b) Self-luminous letters.

(c) Signs so located as to be illuminated by street lights.

(d) Reflecting letters illuminated by headlights of vehicles.

Method (a) provides a positive means of illumination. Method (b) is less positive because of the possible accumulation of dust on the translucent lenses. Method (c) is subject to varying distances from the street lights, improper angles, swinging branches and other interferences. Method (d) is limited in use as indicated under Recommendation 7.

If beacon lights are used in conjunction with signs, the color of the beacon lights should conform to the code of the color meanings for Beacon Signals given on page 27.

Recommendation 6.—Maintenance.

All traffic signs shall be continuously kept in good order and clearly legible.

Recommendation 7.—Height and Location.

Traffic signs shall be located with due regard to the character of the message to be conveyed in order to obtain the maximum observance. The location of a sign giving warning of a hazard just ahead may be quite different from that of a sign giving an order to be obeyed at a particular point.

Fig. 6—Slow Sign—Traffic Turn, Letters, Border and Symbols, Solid Black, Background, Federal Yellow
(*See Recommendation* 22)

For the locations indicated below the signs shall be at the heights specified:

(a) The center of a sign on a fixed post 12 in. back of the curb shall be 8 ft. above the pavement and the sign shall not overhang the curb.

(b) The center of a sign on a movable post in the roadway shall be 4 ft. above the pavement.

(c) The center of a reflecting sign used to mark an obstruction in the roadway shall be 3 ft. above the pavement.

The location of curb signs at a standard height of eight feet is required in order to insure their visibility above pedestrians and vehicles. For the illumination of such signs, dependence cannot be placed on headlights alone.

Fig. 5—Slow Sign—Curve, Letters, Symbols and Border, Solid Black, Background, Federal Yellow
(*See Recommendation* 21)

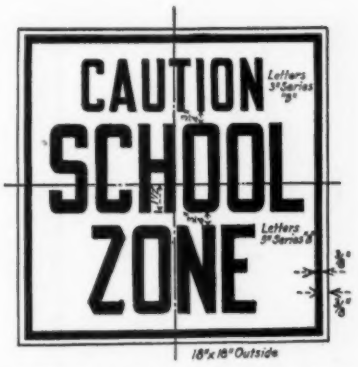


Fig. 7—Caution Sign—School Zone, Letters and Border, Solid Black, Background, Federal Yellow
(*See Recommendations* 24-27)

Railroad Crossing and Railroad Approach Signs

The specifications for railroad crossing and railroad crossing approach signs are taken from the code adopted by the American Railway Association. It is recommended that they be used as standards where they do not conflict with State laws and that State laws which do not conflict be amended.

Recommendation 8.—Railroad Crossing.

(a) A railroad crossing sign shall be made of two arms mounted across each other in inclined positions to form a crossbuck.

(b) The sign shall be placed not more than 15 feet from the railroad crossing.

(c) The letters shall be black on a white background.

The railroad standard code provides two alternative locations for a sign, one at the side and one in the center of the highway. The location in the center is dangerous and is not recommended.

Recommendation 9.—Railroad Crossing Approach.

(a) A railroad crossing approach sign shall be circular, 24 inches in outside diameter, and shall have a bead border around the edge.

(b) The sign shall be divided into quadrants by one horizontal and one vertical line 2½ inches wide.

(c) A letter R, 5 inches high by 3¾ inches wide, shall be placed in each of the upper quadrants.

(d) The sign shall be placed 100 feet or more from the railroad crossing.

(e) If there is a street intersection within 100 feet, an additional sign or

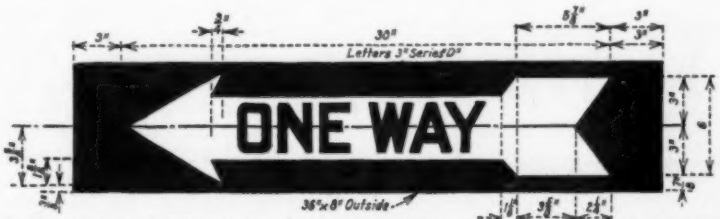


Fig. 8—One Way and Detour Sign, Letters and Background, Solid Black, Arrow, White
(*See Recommendations* 28-30)

Fig. 9—Information Sign—Keep to Right, Letters and Border, Solid Black, Background, White
(See Recommendations 31, 32, 34)

signs shall be so placed as to warn traffic approaching the crossing from each intersecting street.

(f) The sign shall be clearly illuminated at night.

(g) The letters shall be black on a yellow background. (Some States require white instead of yellow.)

Stop Signs

Recommendation 10.—General Specifications.

(a) A stop sign shall be octagonal, 18 in. or 24 in. between parallel sides, as may be best suited to the location. The octagon shall be mounted with two sides horizontal and shall have a bead border around the edge.

(b) The word "Stop," in 5-in. letters, on the 18-in. sign and in 6-in. letters on the 24-in. sign, shall be approximately centered on the horizontal center line of the octagon. (Figure 1.)

(c) The upper and lower spaces may contain specific messages in 2-in. letters on the 18-in. sign and in 3-in. letters on the 24-in. sign, as indicated in recommendations 11 to 15. If, however, a reflecting, fixed or automatic illuminating device is introduced into the sign the outline, size, margin and color scheme as well as the height, shape and spacing of lettering of the principal words shall be retained and the design otherwise adjusted to fit the particular installation.

(d) The stop sign shall be placed at the point where the message is to be obeyed. At intersecting streets this point is on the property line of the protected street.

(e) A stop sign shall be clearly illuminated at night and shall be visible for a distance of 100 ft.

(f) The letters shall be red on a yellow background.

Recommendation 11.—Through Traffic Street.

A stop sign (Figure 1) bearing the words "Through" and "Traffic," or equivalent terms, in the message space, shall be used at every intersection on a through traffic street except those controlled by signals.

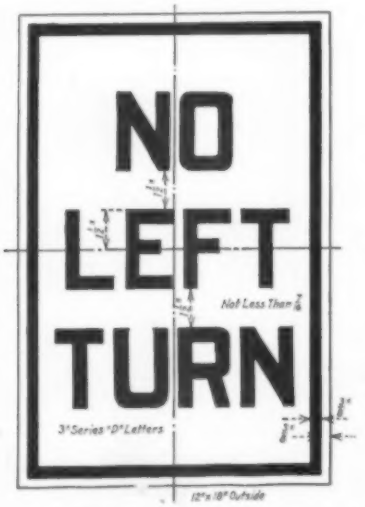


Fig. 10—Information Sign—No Turn, Letters and Border, Solid Black, Background, White
(See Recommendation 33)

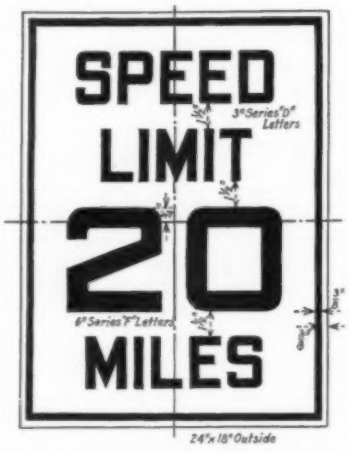


Fig. 11—Information Sign: Speed Limit —— Miles, Letters, Numerals and Border, Solid Black, Background, White
(See Recommendation 36)

(Note: When a sign 30 in. by 24 in., as provided in Recommendation 36-a, is used the words "Speed Limit" shall be in 3½-in. Series E letters, the numerals shall be in 8-in. Series F letters, and the word "Miles" in 3-in. Series D letters.)

Recommendation 12.—Dangerous Intersection.

At dangerous intersections where a stop is mandatory use the stop sign (Fig. 1) bearing the words "Cross" and "Street" in the message space.

Recommendation 13. — Dead End Street.

On a street that ends with no outlet use the stop sign (Fig. 1) bearing the words "Street" and "End" in the message space. This sign is not to be used at "T" or "L" street intersections. (See Recommendation 22.)

Recommendation 14.—Street Closed.

To close a section of a street temporarily use the stop sign (Fig. 1) bearing the words "Street" and "Closed" in the message space.

Recommendation 15. — Signs for Other Locations.

For all other locations at which vehicles should stop before proceeding farther use the stop sign (Fig. 1) bearing a descriptive message. Example: "Car Line."

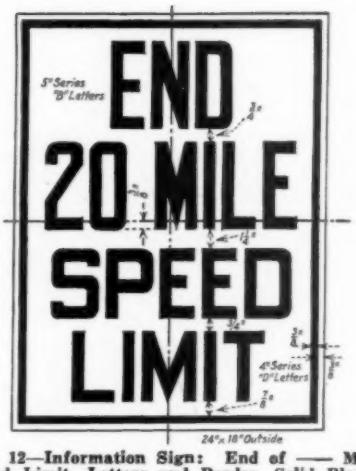


Fig. 12—Information Sign: End of —— Mile Speed Limit, Letters and Border, Solid Black, Background, White
(See Recommendation 36)

Slow Signs

Recommendation 16.—General Specifications.

(a) A slow sign (Fig. 2) shall be a diamond formed by turning one diagonal of an 18-in. square to a vertical position. The sign shall have a bead border around the edge, and the corners may be rounded for safety, using a radius of 1½ in.

(b) The word "Slow" may be placed in 2-in. letters at the top, or a flashing yellow beacon light may be used in the center of the upper space.

(c) Any specific message, such as is indicated in subsequent recommendations, shall be placed approximately in the center of the diamond, but if a symbol is used the message shall be above the center line and the symbol placed below the word message.

(d) In order to give adequate warning of a hazard a slow sign shall be placed sufficiently in advance of the

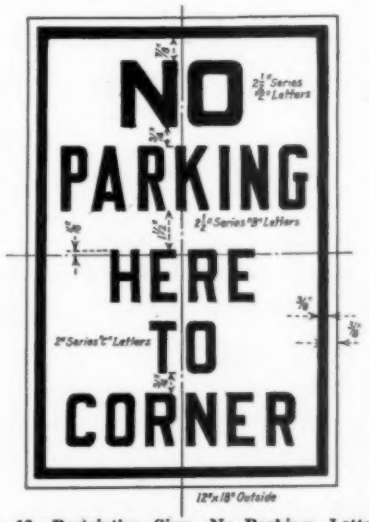


Fig. 13—Restriction Sign—No Parking, Letters and Border, Solid Red, Background, White
(See Recommendations 39-45)

point where the potential danger begins.

(e) The letters shall be black on a yellow background.

Recommendation 17.—Safety Zone.

(a) The slow sign (Fig. 2), with the words "Safety Zone" in 3½-inch letters in two lines in the message space and a horizontal arrow pointing to the right below the words shall be used at every safety zone where traffic is prohibited from passing to the left. Where traffic is allowed to pass on both sides, a double-headed arrow shall be used on such a sign.

(b) The sign shall be placed at the end of the zone that the traffic approaches.

(c) The sign shall be illuminated at night.

Recommendation 18. — Street Car Crossing.

(a) The slow sign (Fig. 2), with the words "Car Line" in 3½-in. letters in two lines in the message space, shall be placed at every crossing that is sufficiently hazardous to require caution.

(b) The sign shall be illuminated at night.

Recommendation 19.—Cross Street.

(a) The slow sign (Fig. 3), with the words "Cross Street" in 3½-in. letters in two lines in the message space and a symbol below to indicate the type of street intersection (+ or ┤ or ├), shall be placed at every crossing which is especially hazardous and requires unusual caution but does not warrant a stop sign.

(b) The sign shall be illuminated at night.

Recommendation 20.—Hill.

(a) At the beginning of a down grade of 6 per cent or more use the slow sign (Fig. 4), with the word "Hill" in 6-in. letters centered on center line in the message space.

(b) For grades exceeding 10 per cent the word "Hill" should be placed somewhat above the center of the sign and the words "Steep Grade" shall be placed below it in 2-in. letters.

(c) The sign shall be illuminated at night.

Recommendation 21.—Curve.

(a) At every curve having a radius of not more than 600 ft. where the conditions require a reduction of speed, use the slow sign (Fig. 5) bearing the word "Curve" in 5-in. letters on the center line in the message space and a curved arrow in the lower space indicating the direction of the curve.

(b) The sign shall be illuminated at night.

Recommendation 22.—Traffic Turn.

(a) At a turn having a radius of less than 200 ft. use a slow sign (Fig. 6) bearing the word "Turn" in 5-in. letters on the center line in the message space and a bent arrow in the low space indicating the direction of the turn.

(b) At a "T" intersection, the directions that may be followed shall be shown by a double-pointed arrow indicating both directions.

(c) The sign may be used at the approach to a regular street intersection where the main flow of traffic makes a sharp turn.

(d) The sign shall be illuminated at night.

Recommendation 23. — Other Locations.

Use slow sign with descriptive message for all other conditions that require vehicles to proceed at reduced speed. For example, "Narrow Bridge," "Viaduct Approach" and "Street Repair."

Caution Signs

Recommendation 24.—General Specifications.

(a) A caution sign (Fig. 7), shall be an 18-in. square mounted with the sides in horizontal and vertical positions. This sign shall have a bead border around the edge and the corners may be rounded for safety.

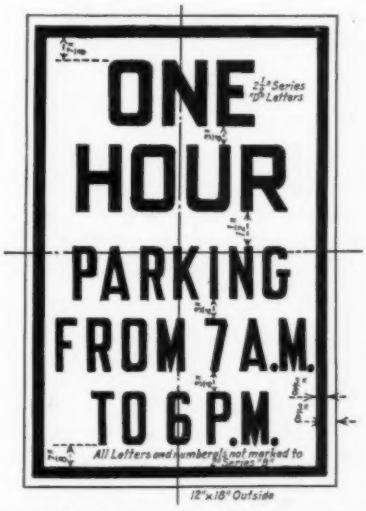


Fig. 14—Restriction Sign—Limited Time Parking. Letters and Border, Green, Background, White

(See Recommendation 46)

(b) The word "Caution" may be placed in 3-in. letters at the top, or a flashing yellow beacon light may be used in the center of the upper space.

(c) Any specific message, such as is indicated in subsequent recommendations, shall be in 5-in. letters and shall be placed approximately in the center of the square, if only one line is used.

(d) If a symbol is used in addition to the word message smaller letters should be used and the words so placed as to provide ample space for the symbol below the words.

(e) In order to give adequate warning of a hazard which is intermittent, a caution sign shall be placed sufficiently in advance of the point where the potential danger begins.

(f) The letters shall be black on a yellow background.

Recommendation 25.—School Zone.

At each end of a school zone use the caution sign (Fig. 7), with the words "School Zone" in the message space.

Recommendation 26. — Playground Zone.

At each end of a playground zone use caution sign (Fig. 7), with the words "Play" and "Ground" in two lines in the message space.

Recommendation 27.—Other Locations.

At every place where vehicles should proceed cautiously use the caution sign bearing a descriptive message. Examples, "Theatre Exit," "Church Zone," "Men Working."

One-Way and Detour Signs

Recommendation 28.—General Specifications.

(a) A one-way sign (Fig. 8) shall be arrow-shaped, 30 in. long by 6 in. high, or rectangular, 36 in. long by 8 in. high, with an arrow 30 in. long by 6 in. high on a black background. In either case the arrow shall be white with black letters.

(b) The message words, in 3-in. letters, shall be centered on the center line of the arrow.

(c) Care shall be taken to fix the sign so firmly that it cannot be turned in the wrong direction.

Recommendation 29. — One-Way Street.

(a) On all four corners of every street intersection where one-way traffic regulations are in force, use a one-way sign (Fig. 8), with the words "One-Way" on the face of the arrow.

(b) If the traffic at the intersection is controlled by an automatic signal the one-way sign shall be made a part of the signal.

(c) On a very narrow one-way street the arrow may be placed on only two corners of the street.

(d) The sign shall be illuminated at night.

Recommendation 30.—Detour.

(a) A one-way sign (Fig. 8), with the word "Detour" on the face of the arrow, shall be placed at the point where a detour begins and at all intersections and other points where any question might arise as to the course of the detour.

(b) At the point where a detour begins a temporary direction sign or route marker placed immediately below the detour sign is recommended to indicate the various destinations that are to be reached by following the detour instructions.

(c) The sign shall be illuminated at night.

Information Signs

Recommendation 31.—General Specifications.

(a) An information sign (Fig. 9) shall be rectangular, with both dimensions multiples of 6 in. and shall have a bead border around the edge, and the corners may be rounded for safety.

(b) The horizontal dimension shall be less than the vertical dimension unless otherwise specified.

(c) The letters shall be black on a white background.

Recommendation 32.—Keep to Right.

A sign (Fig. 9) measuring 12 in. by 18 in. and bearing the words "Keep to

Right," in 3-in. letters, shall be placed at the point where the message is to be obeyed.

Recommendation 33.—No Turn.

(a) A sign (Fig. 10) measuring 12 in. by 18 in. and bearing the words "No Turn" or "No Left Turn" or "No Right Turn," in 3-in. letters, shall be placed at the point where the message is to be obeyed.

(b) If the intersection is controlled by an automatic signal, the sign forbidding the turn shall be attached to the signal and illuminated at night. The dimensions may be reduced to fit the signal housing, but the letters shall not be smaller than 2 in.

(c) The sign shall be illuminated at night.

Recommendation 34. — Dead End Street.

(a) A sign (Fig. 9) measuring 12 in. by 18 in. and bearing the words "Dead End Street," in 3-in. letters, shall be placed at the entrance to a street having no outlet.

Recommendation 35.—Direction.

(a) A sign indicating direction, measuring 18 in. by 24 in., or proportionately larger if necessary to carry the message required, shall be so placed that it will be seen by a driver before he reaches the point at which he should take the direction to be followed. Such a sign is not intended to replace a standard highway route marker.

(b) The important items of the message shall be given in the largest letters possible and explanatory items in equivalent or smaller letters, the size depending upon the number of words used.

(c) An arrow about 16 in. long shall be placed below the message to indicate the direction to be taken. If two directions must be indicated a separarate arrow should be used for each.

(d) The sign shall be illuminated at night.

Recommendation 36.—Speed Limit.

(a) A sign (Fig. 11) 30 in. high by 24 in. wide, or a sign 24 in. high by 18 in. wide shall be used to show the speed limit at the point where the speed limit indicated begins. The larger sign shall be used at all entrances to cities, the smaller at other selected places within the city. Where used to restrict speed on a street within a city, speed limit signs shall be placed at intervals required by law or regulation. At the end of the restricted speed zone there shall be a sign showing the speed of the next zone or a special sign (Fig. 12), 24 in. by 18 in. in size, bearing the words "End—Speed Limit." On this special sign the word "End" and the figures indicating the speed shall be 5 in. high and the words "Speed Limit" shall be in 4-in. letters.

(b) On the regular speed limit sign (Fig. 11), the words "Speed Limit" in two lines of 3½-in. letters on the 30-in. by 24-in. sign and 3-in. letters on the 24-in. by 18-in. sign, shall be placed at the top, the limit in 8-in. or 6-in. numerals respectively, slightly below the center and the word "Miles" in 3-in. letters at the bottom.

(c) The sign shall be illuminated at night.

Recommendation 37.—Quiet Zone.

At each end of a quiet zone use a sign measuring 18 in. by 18 in. wide with the word "Hospital" in 4-in. letters slightly above the center and the word "Quiet" in 3-in. letters below it.

Recommendation 38.—Other Information.

(a) Information signs shall be used to convey any other necessary information, in conformity with the general specifications for information signs. Their dimensions shall be 12 in. by 18 in., if possible.

Restriction Signs

Recommendation 39.—General Specifications.

(a) A restriction sign shall be rectangular, 12 in. wide by 18 in. high, with the principal words in 2½-in. letters at the top, and any necessary explanatory words below in equivalent or smaller letters, the size of the letters depending on the number and length of words used. The sign shall have a bead border around the edge and the corners may be rounded for safety.

(b) The sign shall be placed at the point where the message is to be obeyed.

(c) Where the restriction is to apply continuously for a considerable distance, the signs shall be placed at intervals of about 100 ft.

(d) The wording shall indicate the extent of the application; for example, "In This Block."

(e) Colors shall be:

(1) No Parking, red letters on a white background;

(2) Limited Time Parking, green letters on a white background;

(3) Pedestrian Restriction, blue letters on a white background;

(4) Other restriction signs, black letters on a white background.

Recommendation 40.—No Parking.

In places where parking is to be forbidden use a restriction sign (Fig. 13) with the words "No Parking" at the top and with time limits or other qualifications, if any, below.

Recommendation 41.—Street Intersection.

(a) At a street intersection use a restriction sign (Fig. 13) with the words "No Stopping" at the top and the words "Here to Corner," in 2-in. letters, below.

To avoid the erection of an additional post, a sign reading "No Stopping Within—Feet of Corner" affixed to an existing pole or tree may take the place of this sign. In such a case the point beyond which stopping is prohibited shall be indicated on the pavement or curb.

Recommendation 42. — Fire House Zone.

In a fire house zone use a restriction sign (Fig. 13) with the words "No Stopping" at the top and the words "Fire House" in 2-in. letters below.

Recommendation 43.—Loading Zone.

In a loading zone use a restriction sign (Fig. 13) with the words "No Parking" at the top and the words "Loading Zone" in 2-in. letters below.

Recommendation 44. — Passenger Zone.

(a) In a passenger zone use a restriction sign (Fig. 13) with the words "No Standing or Parking" at the top and the words "Passenger Zone" in 2-in. letters below.

The limits of a zone may be indicated better by curb markings than by a sign at each end of the zone, especially if zones are close together.

Recommendation 45. — Other No Parking Signs.

For any other conditions that require restrictions applicable to the parking of vehicles use the restriction sign (Fig. 13) with the appropriate prohibitive words at the top and other necessary explanatory words below. Eramples, "Taxi Stand," "Bus Stop." The letters shall be red on a white background.

Recommendation 46.—Limited Time Parking.

(a) To indicate the time limit of parking, use the restriction sign (Fig. 14), with the time limit (for example, "One Hour") at the top and the word "Parking" and other qualifications below.

(b) The letters shall be green on a white background.

Angle parking is better indicated by pavement markings than by signs.

Recommendation 47.—No Pedestrian Crossing.

(a) Where there is exceptional danger to pedestrians use the restriction sign with the words "No Crossing," in 2½-in. letters, at the top and any necessary explanatory words below in 1 or 2 in. letters, the size depending upon the number of words used.

(b) The sign shall be so placed as to apply solely to pedestrians. For example, the sign may be suspended between short posts and arranged parallel or approximately parallel to the curb line.

(c) The letters shall be blue on a white background.

This sign is not intended to prohibit pedestrians from crossing streets generally throughout a large area. Educational work against so-called jay walking may be done better by posters than by permanent signs.

Recommendation 48.—Additional Restriction Signs.

Additional restriction signs may be needed for special purposes and shall conform to Recommendation 39.

Enlarging Facilities for Distance Travel Within Great Urban Centers

The Need for a Broadly Designed, Cooperative Program for the Reconstruction of the Trunk Line Facilities Within Great Cities and Metropolitan Areas

By COL. SIDNEY D. WALDON
President, Detroit Rapid Transit Commission

TRAFFIC congestion is greatest in the region of great cities because the facilities are less adequate. For instance, in the city of New York 674,000 registrations have only 2,350 miles of paved streets for both local and through traffic, or an average of 286 registrations per mile. New York, Pennsylvania, New Jersey, Massachusetts and Virginia, with a total of 3,000,000 registrations outside of the large centers of population, have 81,750 miles of roads, improved for through traffic, producing a ratio of 37 registrations per mile. These states also have 182,000 miles of other roads. In other words, there are seven times as many registrations per mile of paved street in New York City as there are per mile of surfaced highway in the five states mentioned.

Again, on Jan. 1, 1929, there were concentrated upon the streets of the Detroit district more motor vehicles than there were in either of the states of Washington, Nebraska, Florida, Tennessee, Georgia, Connecticut, Kentucky, Maryland, Colorado, or in any one of twenty other states. For instance, the Detroit district had 84,000 more registrations than the whole state of Florida, 118,000 more than Georgia, 133,000 more than Kentucky, and exceeded the combined registrations of the five great western states of Utah, Arizona, New Mexico, Wyoming and Nevada by 94,000.

The total miles of all paved streets, for both local and through traffic use in Detroit and the other municipalities making up the metropolitan area, was approximately 2,000. On the other hand, Florida had a surfaced highway mileage for through traffic of 6,340; Georgia 6,380, and Kentucky 9,647, for registrations respectively 84,000, 118,000 and 133,000 less than the Detroit district.

During 1929 registrations in the Detroit district increased 78,000, or at the rate of 1,500 for every week in the year. They have averaged 1,000 per week for several years. By this last increase Detroit registrations have passed those of North Carolina, and are now ahead of thirty-two states and the District of Columbia.

Then again, the Detroit district is growing rapidly and is destined to continue to grow. It is estimated to reach a population of 3,700,000, with 1,250,000 registrations, in 1965; and 5,200,000 population, with 1,750,000 registrations, in 1990.

As traffic is directly related to registrations, could there be a clearer picture of the great need of improving the through traffic facilities in the rapidly growing cities?

A 30-Ft. Road in Allegheny County, Pa.

Registrations to Population in U. S. A.—The United States has one registration to each 4.6 persons. A year ago California had one registration to each 2.87 persons, while five other states had one registration to over three, but less than four persons. It is estimated by students of the subject that the country as a whole will reach one registration to each three persons, and then hold that ratio.

During the 40 years prior to 1920 there were added to the census of the United States approximately 55,000,000 people. The smallest increase per decade during that period was 11,250,000, and the largest 16,000,000. If we assume that during the next six decades we add 15,000,000 per decade, then we will have a population of 211,000,000 60 years from today.

If the ratio of registrations to population holds at one to three, there will be in this country 71,000,000 motor vehicles where we have approximately 26,000,000 today. With an average life of seven years that would mean an annual replacement requirement of over 10,000,000 motor vehicles per year, giving employment to more than 8,000,000 wage earners. This fact is worthy of note by the various committees of President Hoover's conferences to maintain a continuing national prosperity.

If this estimated increase in registrations was spread uniformly over the entire country, it would mean a general increase in traffic of 2.6 times. But unfortunately the tendency is unmistakably towards the increase being concentrated in urban centers.

Population Shift Rural to Urban.—In 1880, 71.4 per cent of this country's population was rural. During the period from 1880 to 1920, 40,000,000 were added to our urban population, while only 15,000,000 were added to our rural population. In other words, over that period city population grew 2½ times as fast as rural population.

Just prior to 1920 this country reached a balance between urban and rural population, having approximately 52,000,000 of each. The rate of increase in rural population, however, has been steadily declining until in the decade 1910-1920 it only amounted to a little more than 1,500,000, while urban population increased over 12,000,000, or almost eight times as fast. This means that urban traffic has been increasing at the same rate.

This shift of population from rural to urban has been taking place quite uniformly—a little over 5 per cent per decade. It would only have to continue three more decades before the relationship that existed in 1880, when we had over 70 per cent rural population, would be reversed and we would have over 70 per cent urban. In other words, by 1965 our urban population should have reached 120,000,000 with little or no substantial increase in the present rural population.

Do you realize the vital significance of this population shift?

It means that the greatest need for increasing traffic facilities has already shifted from rural to urban areas, with this shift of population. It means that increases in population, registrations and traffic, as well as the great bulk of the revenues for increasing the capacity of trunk line highway and thoroughfare systems, will be found within the urban centers of this country.

Our National Highway Program.—When the automobile first appeared up-

Complete North and South 30-Ft. Units of Superhighway in Waukesha County, Wis.

on the scene, the city man had the edge on the farmer because the only pavements for year-around motor vehicle use existed in cities. For months out of each year country roads in every direction were a sea of mud, and motor travel was next to impossible.

It took nearly ten years to convince the farmer, the strongest opponent of improved highways at that time, that he would benefit most from their construction. When finally convinced, he joined hands with the city man in obtaining State and Federal Aid in building the greatest system of improved highways in existence. Income for the nation's highway budget last year was $1,500,000,000. That would build four Panama Canals, and still leave $100,000,000 or sufficient to construct a concrete highway from the Atlantic to the Pacific.

Our stupendous highway program has benefited every section and every individual in the United States. By making land more accessible it has made it more valuable. By enormously increasing the mobility of the individual it has also increased his usefulness, his earning power and his ability to enjoy life. By building a great highway system we have made possible a mammoth industry that has nourished every other industry, and made this country prosperous. Lastly, the users of motor vehicles, by their taxes, are rapidly paying off the bonds that built the roads they use.

Today, the farmer has the edge on the city man. The farther one leaves the great cities behind, the more delightful the motor ride becomes. The states and the Federal Government, with taxes supplied in great measure by cities, have built the world's greatest system of highways, up to the gates of our great centers, and there they stop. The nearer we approach the center of a city, the greater becomes the congestion and the difficulty of moving. In many places streets are becoming so choked with vehicles, during certain hours of the day, as to materially reduce, if not destroy, the incentive to own and use a motor car.

Registrations to Population in Leading Cities.—The wide variation in the relation of registrations to population in large centers can best be illustrated by the various boroughs of our greatest and wealthiest city, New York, in comparison with six other important cities:

	Persons per Registration
Borough of the Bronx	12.0
Borough of Manhattan	11.4
Borough of Brooklyn	10.2
Philadelphia and Chicago—each	7.6
Borough of Richmond	6.2
Boston	6.
Borough of Queens	5.4
Cleveland	5.3
Detroit	4.
Los Angeles	2.

Los Angeles has approximately six times as many registrations per unit of population as Manhattan and the Bronx, while Detroit has three times as many.

Influence of City Facilities on Employment.—Traffic within any city depends not only upon its own registrations, but also upon that of other adjacent municipalities. However, let us take the present city limits of New York, with a population of approximately 6,400,000, and estimated to be 11,278,000 in 35 years. What will be the number of motor vehicle registrations? Will they remain constant at the present figure of 674,541? Or will they arrive at the estimate of the New York Regional Plan, or at some one of the present ratios given in the preceding table, which, if applied to the 11,278,000 population estimated for 1965, would produce the following registrations:

	Registrations
The Bronx—ratio of 12. to 1 equals	940,000
Philadelphia and Chicago—ratio of 7.6 to 1 equals	1,484,000
Boston—ratio of 6. to 1 equals	1,879,000
Cleveland—ratio of 5.3 to 1 equals	2,128,000
Estimate of New York Regional Plan—ratio of 5. to 1 equals	2,260,000
Detroit—ratio of 4. to 1 equals	2,820,000
Los Angeles—ratio of 2. to 1 equals	5,640,000

It will be noticed that the range of registration possibility within the city limits of New York is from 674,541, the registrations of today, and 5,640,000, the figure for 1965 if the present Los Angeles ratio could be applied. The difference is almost 5,000,000 registrations, or the equivalent of an average year's output of the entire automobile industry now employing 4,300,000 men. What is much more important, however, this difference would mean an annual replacement requirement of over 700,000 vehicles per year, which alone would give employment, year in and year out, to 600,000 wage earners.

Urgent Need of Regional Plan.—These figures are presented in this way for the purpose of arresting your attention. We are all prone to accept the present situation in city growth as final, and to lose sight of the fact that it is but a momentary phase of endless change. Vacant areas become filled with buildings that in turn outlive their usefulness, and either make blighted areas or are replaced by more modern structures.

What we should do is to look forward and take certain simple and logical steps to provide for the inevitable. Our great cities are destined to grow through generation after generation. Every metropolitan area, country and state should have a plan—a Master Plan—a regional plan superior to municipal boundaries, and one that in its gradual accomplishment will constantly keep step with increasing traffic needs.

Detroit's Master Plan.—The ultimate minimum highway standards in Wayne County are 40 ft. of concrete in a 120-ft. right of way, or two 40-ft. roadways in a 204-ft. right of way. The Master Plan, including these standards of right of way width, has been officially adopted by the three counties of Wayne, Oakland and Macomb, and by the various municipalities making up the Detroit district. There is also the 150-ft. boulevard right of way as exemplified in Grand Blvd., Oakland Blvd. and the Outer Drive, the three totaling 57 miles, 33 miles of which are now in daily use.

Under special legislation Superhighway Commissions have been created for the acquirement of the Master Plan rights of way, and a Supreme Court decision has approved the necessity of dedication in accordance with the standards of right of way width of the Master Plan.

During the past five years over 600 miles of frontage right of way has been acquired upon routes of Detroit's Master Plan, in accordance with these standards.

Some Superhighway Accomplishments to Date.—The larger standard of 204 ft. is used on 251 route miles in the outer area. There are twenty such superhighways. Some idea of accomplishment will be obtained by listing a few of these 204-ft. superhighways,

with the mileage planned, right of way acquired, and miles already in use:

	Miles Planned	Miles Right of Way Acquired	Miles in Use
Fort Street	11.14	6.	6.
Michigan Avenue	15.45	14.	14.
Schoolcraft Avenue	10.75	5.	.....
Grand River Avenue	5.16	5.	3.
Northwestern Highway	33.	7.3	7.
Woodward Avenue	12.3	10.3	10.3
Stephenson Avenue	19.5	6.	3.
Mound Avenue	8.88	6.	6.
Southfield Road	23.4	11.5	6.
Eight-Mile Road	21.2	15.6	15.6
	160.78	86.7	70.9

Of the 160 route miles of 204-ft. superhighway listed, it will be noted that 54 per cent of the right has been acquired, and 44 per cent is in use.

The 120-ft. width was adopted because when absorbed into and become a thoroughfare of a great city, it provides one lane for loading and unloading at the curb, a second lane for right turns, a third for through traffic, and a fourth for left turns—all between the curb and street car safety zones. With street cars eliminated, it provides two local traffic lanes for right and left turns, and two through traffic lanes between the parked vehicles at curb, and a pedestrian "isle of refuge" in the center of the street.

In our opinion no section line road or main arterial thoroughfare should have a lesser width than 120 ft. Intersections of main highways have a habit of collecting gasoline stations, garages, grocery stores, houses and other buildings that are attracted by the traffic, and if uncontrolled as to location, present problems of great aggregate expense when increased traffic demands increased width.

Development by Direction or Drifting.—The existence of a Master Plan, supported by proper authority for its execution, causes development to occur in an orderly manner, in accordance with the increased traffic requirements such development is bound to create. Every city that has opened and widened a main artery by condemnation can appreciate the hundreds of millions of cost the existence of a Master Plan will save the taxpayers of the city of Detroit through generations to come. But better than this saving in condemnation costs is the fact that these increased traffic ways are being made ready automatically and immediately that they are needed, without the necessity of suffering years of intolerable congestion leading up to action to condemn.

History has proven over and over again that we pay for adequate traffic facilities, whether we have them or not. If we make no forward looking plans we pay through delays and reduced efficiency. We pay through nervous wear and tear, through loss of property, life and limb. We pay in stunted development, in blighted areas and lessened values. And as a last resort we pay enormously for a few defensive measures that too often fail because inadequate. It is better to grasp opportunity while it exists, and consistently plan ahead of immediate needs than to let things drift until it is too late.

The Cycle of Benefit.—It may be argued that the cost of providing facilities within the present limits of the city of New York for an increased registration of 5,000,000 vehicles by 1956 would be so expensive as to be prohibitive. Let us look at that side of the matter for a moment.

Last year 26,400,000 registrations paid total motor vehicle taxes of $925,000,000, or an average of $35 per vehicle. The total annual tax on five million vehicles at the same rate would be $175,000,000. In other words, tax revenue keeps pace with registrations. This amount would be enough to pay for three Holland Vehicular Tunnels and five Bear Mountain Bridges every year. Exclusive of right of way and property damage, $175,000,000 would build a four-lane elevated roadway four times around the Island of Manhattan every year. And this amount would be paid by the increase only in registrations within the present limits of the city of New York.

And so we develop the same "cycle of benefit," with respect to increasing the traffic facilities in great cities, as has already been demonstrated in connection with the highway systems of this country; namely, the creation of new traffic facilities stimulates the ownership and use of motor vehicles, thereby increasing employment and prosperity on the one hand, while on the other hand it provides the funds with which to pay for the new traffic facilities that make the increases in registration possible.

Need of Super-Authority.—The facilities of this country for the handling of through or distance travel fall into two distinct groups—

(1) Trunk line highways, including the Federal Aid System, under the direct jurisdiction of the State Highway Departments.

(2) Trunk line thoroughfares in metropolitan areas, generally under the jurisdiction of a multiplicity of municipal governments.

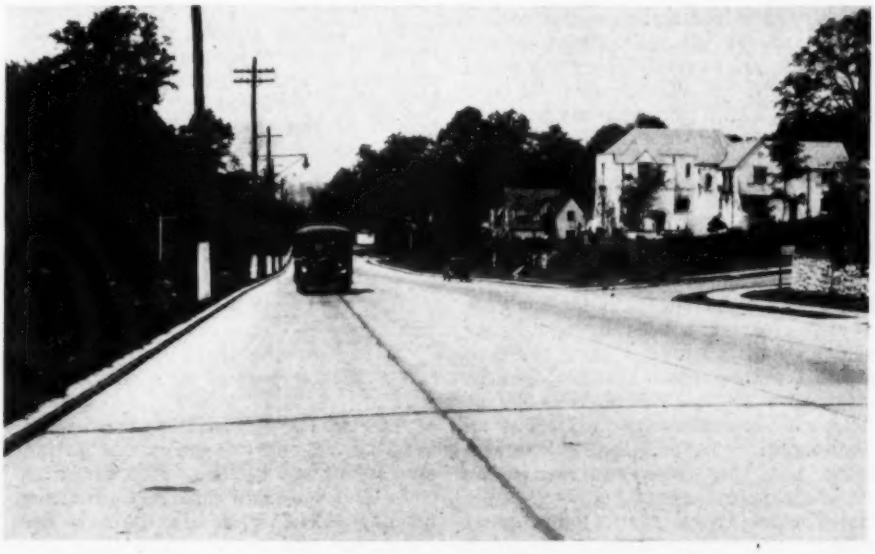
In the State governments are concentrated large powers and large funds that may be expended in a continuing program upon the trunk line highways of the State, in such manner as to make continuing improvement keep pace with increasing speed.

In metropolitan areas is presented the problem of bringing about coordination and cooperation among many different municipal authorities, the executives of which are generally in office too short a time to complete any but the simplest works that they may initiate. The result is either lack of program or lack of continuity in its execution. If a plan exists there may be adherence to it in one area and disregard in the area adjoining. In the aggregate, enormous sums are raised annually, and will continue to be raised through motor vehicle and other taxes, which, if they could be concentrated in the hands of some super-authority, like the Metropolitan Board of Boston, the Port Authority of New York, of the State Governments, are ample to keep through traffic facilities abreast of through traffic needs.

The problem is to get the available funds wisely applied in the right place, in accordance with a properly drawn Master Plan.

An Unused Power for Good.—Probably the most powerful influence for increasing the capacity of American highways lies unused in the hands of the Federal and State Highway Departments. It is the adoption of a uniform standard of width of right of way as a prerequisite to the expenditure of Federal or State funds for the building of roads.

When industry decides to put money into the building of a factory for a



City Line Ave. in Philadelphia, Pa.

growing business, it acquires an excess of land over and above that necessary for its initial factory unit. It knows that the erection of the plant, together with housing and other development that will be stimulated in the neighborhood, will make additions to its land area at a later date both difficult and expensive.

In road building, the concrete or other surfaced area may be likened to the factory of a growing business, while the right of way—that is, the land between property lines, may be likened to the area available for future plant expansions.

Nearly 700 millions of Federal Aid money has been added to 700 millions of State moneys and expended in a nationwide program of road building, with no standard "right of way" requirement. The Bureau of Public Roads requires certain engineering and construction standards to be met in order that participation may be had in these funds. Private industry would demand, as an act of ordinary business prudence, that one of the most important requirements should be the provision of a right of way adequate for future expansion, as well as for present needs.

When the ever-increasing needs for foot paths or sidewalks for the safety of pedestrians, and tree planting and roadside development, are added to the space required for ditches or other drainage structures, public service poles, and proper provision for future pavement widening, it will be seen that 120 ft. is little enough for a trunk line highway.

The nearer the highway is to a great city the greater is the need of this width, and the more remote it is from any large center, the lower is the cost of acquiring it when compared with the cost of the road surface to be laid, and the greater the returns to the district and state when tree planting and roadside development has fully matured.

Commendable Achievement. — Two meritorious examples of wise planning for our ever-increasing motor traffic, as well as for the most desirable environment, are exemplified by the parkway system of Westchester County, New York, and a plan recently put into effect by Grover C. Dillman, State Highway Commissioner of Michigan.

In Westchester County the Park Board is carrying the separation of through traffic from local traffic to the maximum degree. In addition to the old idea of widely separated park areas, designed on the square mile basis, it is also creating others by the linear mile as long parkways that are connected together into a system. Widths vary from 200 to 300 ft. to 1,000 or more. These parkways still serve all the purposes of recreation and amusement, but they also provide in an unique manner the new requirement of fast distance travel for traffic in great volume, and couple with it the most pleasant environment for such travel.

Mr. Dillman is acquiring rights of way 400 ft. wide along trunk line routes through virgin timber and sections of natural beauty in northern Michigan. The purpose is to preserve to future generations as much of this timber as still stands adjacent to main highways, and to promote reforestation within this width in other places, so that those sections of the State traversed by such routes may possess one of the greatest natural scenic attractions to the motoring public.

Contrast a ride along a broad, modern highway through miles of primeval forest, with its infinite combinations of pine, spruce, hemlock, tamarack, cedar and other trees, and with plenty of room in which to ride, see and enjoy, with a procession down a narrow canyon of billboards, gasoline stations and hot dog stands. The motoring public is quick to appreciate the difference, and to indicate its approval.

Mr. Dillman has given evidence of an unusually clear vision of what motor traffic seeks, and will go a long way to find. He is making a wise investment for the State of Michigan that will continue to pay dividends for all time.

State Aid to Cities.—Federal Aid is accomplishing so useful a purpose in raising the standards of highway construction in all of the states, that it is doubtful whether even if the law permitted its funds to be used for trunk line thoroughfares within cities, it would be wise to do so. There is, however, every reason why State governments, deriving the majority of their highway revenue from the taxation of motor vehicles owned and operated to so large an extent upon the streets of great cities, should from now on use an increasing proportion of the revenue so received in bringing about the improvement of trunk line traffic facilities in those cities and metropolitan areas.

Just as the intelligent use of Federal Aid funds upon a broadly designed national system of highways automatically brings about cooperation between states, so would the use of state funds invite the active cooperation of municipalities upon the carrying out of a program designed for the greatest benefit of the metropolitan areas and of the state.

That this view is receiving the serious consideration of forward-looking state highway officials is evident from the following quotation from an interview given out at Lansing, Mich., by Grover C. Dillman, State Highway Commissioner:

"It is time the state started spending a suitable part of its money in the cities.

"For the last six years we have spent 17.45 per cent of our receipts in paving streets through villages. This amounted to $21,749,000 from construction money totaling $124,865,000. In the next five years we will spend more than this sum in cities exclusively.

"We plan to spend large amounts in aiding cities to widen and improve their main thoroughfares which are used as trunk line highways."

Study of the census figures for this country indicates that almost all of the next 55 millions that are added to the population of this country will be urban. Urban population is growing between eight and ten times as fast as rural population.

Adequate traffic facilities, plus population, produce motor vehicle registrations. Traffic and motor vehicle revenue are directly proportional to registrations.

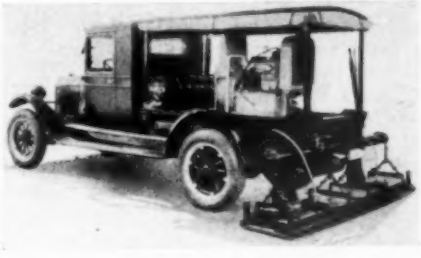
If the public trend toward universal use of the motor vehicle is a thing to be encouraged as being of benefit to all of the people, then this country must get behind the same sort of broadly designed, cooperative program for the reconstruction of the trunk line facilities within great cities and metropolitan areas, as it formerly united behind the program for the creation of our present state and Federal Aid highway systems.

Wise planning will reduce cost and increase accomplishment. Through traffic recognizes no municipal, county or state boundaries, and neither should the measures for traffic relief.

Acknowledgment.—The above is an abstract of an address presented Jan. 9 before the Society of Automotive Engineers.

Magnetic "Nail Pickers" Are Used in New Mexico

The maintenance equipment of the State Highway Department of New Mexico includes five magnetic "nail-pickers." During 1929 these machines removed from the highways of New Mexico 131,194 lb. of material consisting of every conceivable piece of metal from a carpet tack to a horseshoe.



Magnetic "Nail-Picker" of New Mexico State Highway Department

The mileage of road covered was 29,-113. The machines were kept in continuous operation and go over the system from five to six times per year. The cost of this work was $10,000. The average weight of metal removed was 4.5 lb. per mile. The types of road covered were as follows:

Type of Surface	Distance Covered, Miles	Cost	Wt. of Metal, Lb.	Wt. per Mile, Lb.
Concrete	1,022	$ 317.76	2,396	2.3
Oil-Processed	1,264	350.39	3,468	2.7
Gravel, etc.	14,588	4,979.75	51,625	3.5
Earth	12,239	4,352.10	45,601	3.7

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Three Billions for Highways in 1930

The number of motor vehicles registered in America in 1929 was 26,562,713 as compared with 24,479,648 in 1928; or an increase of 8.5 per cent.

Since 58 per cent of the total annual expenditure for state highway work comes from gasoline taxes and motor vehicle fees, this 8.5 per cent increase in the number of motor vehicles means at least an equal increase in the funds available for state road construction and maintenance, or about $75,000,000 increase, not to mention another $10,000,000 increase, from the same cause, in local road improvement funds for 1930.

Great as is this annual increase in road work due to an increase in the number of road vehicles, it falls short of the total increase, for gasoline consumption (and therefore gasoline tax money) is mounting faster than the number of motor vehicles. Nor is this all. A recent survey made by the American Road Builders Association showed that the state highway departments plan to spend 23 per cent more in 1930 than was spent in 1929 (see *Roads and Streets*, January, 1930).

In a splendidly comprehensive review of the amount and sources of highway income (*Roads and Streets*, February, 1928), Thomas H. MacDonald, Chief of the Bureau of Public Roads, showed that in 1928 the grand total expenditure for improving rural roads was $1,660,000,000, in round numbers, of which almost exactly half was spent under the direction of state highway departments and half by the counties, townships and other local units. He showed that in 1928 the sum of $493,000,000 was raised for state road work by the taxation of motor vehicles and their fuel, as compared with $163,000,000 in 1923. This is an increase of 200 per cent in 5 years—a truly amazing rate of increase in funds annually available for state road improvement. If any skepticism exists as to the estimated increase of 23 per cent in state expenditures for road work in 1930 over 1929, this record of actual increase during five years should dispel it.

In addition to the rapid annual increase in road construction resulting from rapidly increasing income from gasoline taxes and vehicle licenses, there has been no slight increase as a result of bond issues. Mr. McDonald shows that in 1928, about $270,000,000 of the state and local expenditures for roads came from bond issues, of which $120,000,000 was state and $150,000,000 local. He advocates the continuance of the policy of raising money by bonding, in all cases where the annual revenue from taxes is insufficient to improve roads at an economic rate. He points out the fallacies in the policy of "pay as you go," many of which fallacies this journal has been pointing out since it was founded. Buying roads on the installment plan, by bonding, is no more reprehensible than buying automobiles on the installment plan.

If, as seems probable, a 20 per cent increase in expenditures for rural highways occurs in 1930 over 1929, the total will greatly exceed $2,000,000,000; for it should be noted that Mr. MacDonald's total of $1,660,000,000 was for 1928, "local" expenditure figures for 1929 not being available. This does not include expenditures for street improvement and maintenance, which the Hoover committee on public works expansion estimated at $1,000,000,000 in 1930.

When the world war ended we were calling highway construction "a billion dollar industry," and some of us still speak of it as that. It has grown to be a three billion dollar industry, and the growth has been so rapid that few of us have realized its magnitude.

How to Reduce Highway Accidents

From Sidney J. Williams, Director of the Public Safety Division of the National Safety Council, we received the following letter:

"I have just been reading with interest the editorial in your February issue on "Mechanical Speed Regulators for Reducing Traffic Fatalities." Your comment on the increase in such deaths in Los Angeles and elsewhere is especially interesting to us at this time because our staff is engaged in a determined effort to analyze the reasons for the unprecedented national increase in 1929.

"As a matter of detail, permit me to call your attention to the fact that the motor vehicle fatalities last year in the United States were not 9,000 but 31,500, according to our preliminary estimate based on state reports, this being an increase of about 12 per cent over 1928; and there are about 35 non-fatal personal injuries from such accidents for every fatality."

In our February editorial we suggested the use of automatic speed regulators on all motor vehicles, the regulators being so designed that, upon entering a zone of restricted speed, the driver would switch on his speed regulator and thus effect a semi-automatic obedience to the speed law. There should probably be three speed switches on each speed regulator, and an external light corresponding to each speed, so that it would be evident whether the driver were obeying the speed requirements.

Stop-and-go signals have done much to reduce motor vehicle casualties; but the startling increase in the number of highway fatalities in 1929 as compared with 1928 indicates the crying need of further automatic protection. The number of motor vehicles increased 8.5 per cent as against a 12 per cent increase in the number of fatalities, and this in spite of countless daily paper editorials and preachments of every sort.

When we spoke of 9,000 fatalities we had in mind only the deaths of drivers and passengers in motor vehicles. More than twice that number of pedestrians are killed annually by motor vehicles; and we inadvertently did not include them.

The motor-vehicle mileage per annum can be quite closely estimated from the total number of gallons of gasoline consumed. Then assuming 2.8 people per vehicle, we find that the fatalities among riders per automobile rider-mile are 30 times as numerous as per railway passenger-mile. It is probable that the assumption of 2.8 riders per automobile is somewhat too high, for while traffic surveys on country roads indicate about 2.8 persons as the average, motor cars on city streets seem to average fewer than two persons per car, except on holidays. It would not be surprising, therefore, if fatalities among riders in motor vehicles were 40 or even 50 times as numerous as fatalities among train riders, based on passenger-mileage. It is highly important that this ratio be accurately determined, for only by such comparisons will the public be awakened to a full realization of the enormous risk at present involved in the operation of motor vehicles. There is no consolation in the fact that flying is vastly more dangerous than motoring. Airplanes at least have the merit of killing few besides the fliers.

The manager of a certain street car company found that 90 per cent of their accidents were caused by 10 per cent of their motormen. Perhaps a somewhat similar ratio exists among motorists as to relative carefulness. But while a street car company is able greatly to reduce its accidents by weeding out careless motormen, no such means is available to those who are striving to reduce highway accidents There is, however, an available, but almost untried, means of reducing motor vehicle accidents, namely, the mechanical speed regulator. A few motor trucks are equipped with these devices. We can think of no more promising experiment than equipping all the motor vehicles in one or two large cities with them. Let the cost of such an experiment be what it may, it would weigh as nothing compared with the value of 31,500 lives annually forfeited to present carelessness and ignorance.

Let Us Test Our Educational Methods Experimentally

Up to the present time, although many experiments have been made in education, still pedagogy can hardly claim to be an experimental science. Each new method of teaching rests upon certain psychological assumptions, but where is the experimental evidence that any given method produces results superior to all other methods?

An experimental science proceeds by trying different combinations of forces, and measuring the results in each case. This could, and should be done in teaching. For example, there are two doctrines relating to the teaching of science; one doctrine being that science is best taught by drilling students in solving problems by applying certain principles or laws; the other doctrine being that science is best taught by drilling the student in original research. Yet where has the experiment ever been made of measuring the scientific efficiency of two groups of students drilled under these two methods? It would not be a difficult experiment to conduct, and the result might revolutionize the teaching of science in America.

Although such an experiment has never been made, still it seems possible to gage its probable results by observation. In Germany, for example, science has been taught for several generations by the research method; whereas in America it has been taught mainly by requiring students to memorize principles and solve set problems by their aid. An excellent test of the efficacy of the two methods would consist in ascertaining the number of scientific discoveries per 1,000 of graduate scientists in Germany and America during the past 30 or 40 years. A crude application of this test consists in counting the number of modern scientists whose discoveries are cited in any treatise that covers a broad field. Such a treatise is "The Electron Theory of Matter," by Prof. O. W. Richardson, of Kings College, London, published in 1914. In the index of 235 names cited we find:

German	102
English	81
French	34
Italian	6
Dutch	5
American	4
Russian	2
Japanese	1
Total	235

When we find ourselves here beaten 26 to 1 by the Germans, 20 to 1 by the English and 9 to 1 by the French, our national pride takes no slight fall.

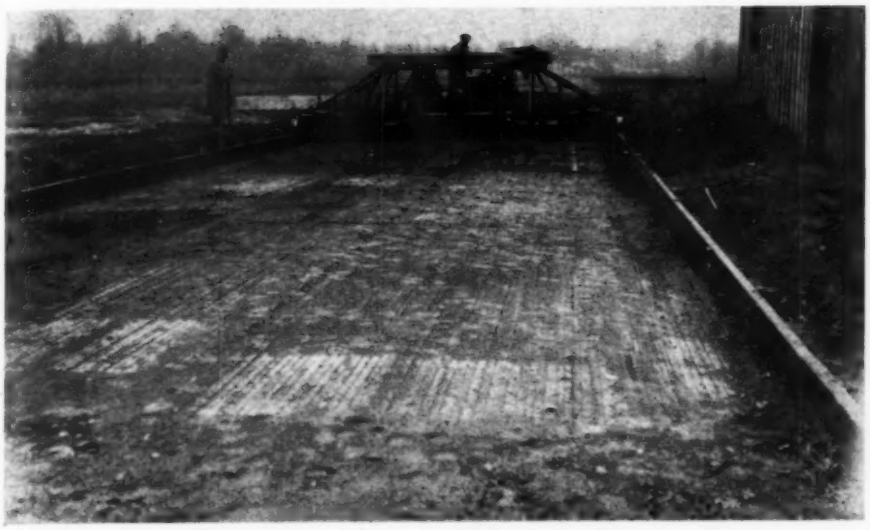
The plain truth is that only within the past decade have American schools really begun to train scientists by the research method, and then only in very small numbers compared with the very large numbers who study the sciences. It is our belief that we have blundered terribly in not using the research method of training, not merely in pure science but in applied science. At any rate there is clear evidence that Americans have discovered relatively little in the realms of pure science. This can not spring from any lack of originality, for our inventors have been as prolific as our pure scientists have been barren.

During the past decade there has been a growing tendency in America to adopt the German and English methods of research training. Many large industrial companies have established research laboratories. Several of our scientific and engineering schools have begun to train some of their students in research; although this is still a far cry from giving all of them a good grounding in research methods.

We suggest that, say, 1,000 students of engineering be thoroughly trained for four years by the research method of training and that another 1,000 who are receiving the present type of training, be selected for a test. At their graduation, let them be tested in practical ways (not by the ordinary question and answer method) as to their respective abilities to solve such problems as confront the practicing engineer. Furthermore, let records be kept of their respective achievements during 10 or more years after graduation.

There has been enough deductive argument about different methods of education. Let us now have adequate inductive research as to the different methods.

F. P. Gillette



Subgrade Cut by the Precision Grader

A New Subgrader

A new grader for preparing subgrades has been announced by the Engineering Development Co. of 1070 Union Trust Bldg., Cleveland, O.

The makers claim this tool will cut very hard soils and even level an occasional large stone within ⅛ in. of specified grade. The cutters are adjustable "stelited plows" which rotate on a series of shafts. When encountering any obstruction which cannot be easily cut the machine automatically back away returning upon the next revolution of the cutters to the attack. It is claimed that no amount of resistance can stall the engine or break any element. Traction and reduction gearing are enclosed as well as the chains which drive the cutters. Traction has two speeds forward and one reverse.

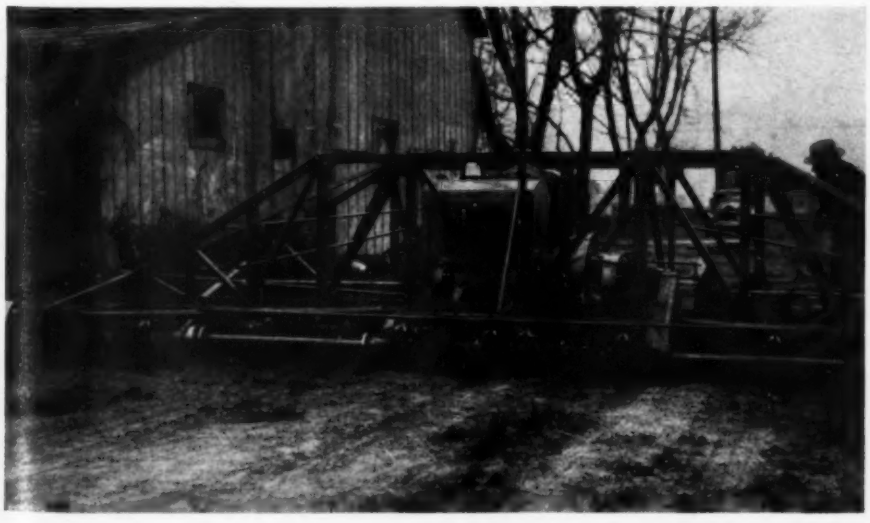
Means are incorporated for removing the spoil dug from the subgrade. The machine can be changed in width from 9 ft. to 20 ft. It also can be changed to meet practically all variations in subgrade section throughout the various states.

Ball bearings are liberally used for all important bearings and steel alloys are used in most castings and shafts.

Three wheels with a total wheelbase of over 10 ft. propel the machine on each form. These wheels always maintain a straight line of contact. The makers claim that any form set to grade capable of supporting a finishing machine without getting out of grade will stay in grade under the operation of the "Precision Grader."

The machine has cut subgrade on a 150-ft. radius curve. Means have been provided for driving one side only. The weight of a 20-ft. machine is 8,400 lb.

The "Precision Grader" is the combined invention of the late William Ord, G. Maxon, Jr., and C. G. Thayer, Jr., all of many years' experience with contractors' equipment.



The Precision Grader

New Anthony Truck Bodies

Three new truck bodies have been announced recently by Anthony Co., Inc., Streator, Ill.

The new Anthony rotating power hoist body has been built to supply light truck users with a power body in line with Gravity Body prices. The gear case used on this unit is one that has been built like a truck transmission to stand abuse. It was tested with 100 per cent overload, under continuous operation for 250 hours, at the rate of three dumps per minute. At 1,000 rpm. of motor, the body is stated to dump in four seconds. A large steel worm running into a large bronze gear makes up the inside of the case. A case hardened steel pinion turns a steel bull gear, which in turn pushes arm and raises body. Automatic latch on front of body holds same in riding position, relieving strain on all gears and pinions. An automatic release throws power take-off out of gear when body is in full dumped and riding position. This body is furnished in 1 yd. convertible to 2 yd. base and 1½ yd. convertible to 2 yd. base. It is possible to mount other special capacity and designed Anthony boxes on this understructure.

New Rotating Power Hoist Dump Body

Anthony rotating fast hand hoist is almost automatic in action, requiring only 4½ turns of crank to put body in dumping position. Being a rotating unit, only 4½ turns in the same direction and body returns to riding position. The same type of construction is used in rotating power lift. This unit is also equipped with latches to hold body at any angle for safety and convenience.

A general purpose body designed to meet practically any kind of contracting and hauling conditions is also a recent addition to the Anthony line. The sides being removable will facilitate the speedy handling of such materials, as it can be loaded from the side and stacked on the platform. This body is made in the standard 84-in. by 60-in. base with 18-in. head and tail. The new rotating power lift understructure is the standard lift used. The construction is of one piece steel, ten gauge, electrically welded. All of the above bodies, as well as all other Anthony bodies use heavy, built up steel rockers, on which load is carried and dumped. Eccentric double-acting tailgates are standard equipment.

New Gravel Washing, Screening, Crushing and Loading Plants

Washing, screening, crushing and loading plants have been added to the line of the Pioneer Gravel Equipment Manufacturing Co., Minneapolis, Minn. The company is now manufacturing three sizes of these plants, in addition to its large line of portable screening, crushing and loading plants for both gravel and concrete road work.

In the new "Pioneer" equipment, Plant 44W is the smallest. This plant consists of a 21-yd. bin in two compartments and a 2½-yd. sand hopper or preferably a 5-yd. bin to be used as a sand compartment. One compartment of the 21-yd. bin is used for coarse aggregate and the other for pea gravel rejects. Mounted into that portion of the 21-yd. that is used for pea gravel and extending over the sand bin or hopper is a sand drag and settling tank designated as a dehydrator. This dehydrator takes the sand out of the settling tank and by a paddle arrangement conveys it to the sand hopper. This device has proven very satisfactory under the extremely dirty conditions that prevail in some gravel deposits.

Mounted over the 21-yd. bin is a Pioneer anti-friction bearing equipped shaker screen. Where the 2½-yd. sand hopper is used, the Pioneer No. 3 Screen is standard. Where the 5-yd. hopper is used, the Pioneer No. 4 Screen is standard. Both of these screens are equipped with "SKF" bearings in the screen hangers and "SKF" bearings in the screen eccentric of the overhead drive. The No. 4 Screen is 15 ft. long and the No. 3 Screen is 10 ft. long.

Over the bin and attached to the screen are the necessary spray plates and mixing plates, and on side of the bin is a 5-in. water piping through which the silt, dirt and water is permitted to flow away. The plant is equipped with an adjustment for the inflow of water enabling the user to regulate the amount of sand that he wishes to reject. The sand comes with the dirt through the water overflow pipe.

This plant is equipped with a Universal jaw crusher mounted on truck with 21-ft. bucket elevator delivering the oversize material back on the screen. The size of the crusher wanted will depend upon the customer's requirements to crush.

The plant is also equipped with a regular 70-ft. Pioneer belt conveyor which is termed the feeder conveyor. This conveyor is furnished in three different widths.

This plant is stated to have an input capacity of better than 500 tons per 10-hour day.

Aside from the plant just described, two larger washing, screening, crushing and loading plants are manufactured—301W and 300W. 301W is built along the lines of the 44W. It is, however, built over and into a 37-yd. storage bin which has three compartments. Over the storage bin is the Pioneer No. 4 "SKF" equipped shaker screen and over the shaker screen is mounted a 42-in. diameter 16-ft. long revolving screen, around which is built a 57-in. steel jacket. This revolving screen is equipped with a scrubber. Accordingly, the 301W Plant has 31 ft. of screening surface. This plant is stated to have an input capacity of 70 to 80 tons per hour and is equipped with 80-ft. 24-in. feeder conveyor, crusher mounted on truck with bucket elevator to return the crushed material for sizing.

The 300W Plant is the largest plant. It is mounted on wheels, making it easily adaptable for moving from place to place. It has the same screening capacity and arrangement that is found in the 301W. Instead of storage space, it uses delivery conveyors for stock piling. At the discharge end of the delivery conveyor, the user may have storage hoppers in case stock piling is not found to be convenient. This plant has an input capacity of approximately 80 tons per hour. An 80 hp. Waukesha engine is used for power on the 301W and 300W plants.

View of 44W Pioneer Washing, Screening, Crushing and Loading Plant, Operated by Davis & Wakeman, Near Lebanon, Mo.

New Tar and Asphalt Melting Kettles

Oil burning tar and asphalt melting kettles designed for municipal, county and state highway maintenance officials and paving contractors, have been added to the line of the Hauck Manufacturing Co., 126 Tenth St., Brooklyn, N. Y. The outfit burns kerosene, coal oil or light furnace oil and is stated to produce hot asphalt 10 minutes after starting burner; continuous thereafter. The kettle design and construction permit high speed trailing (without damage to kettle) and hard usage.

Hauck Tar and Asphalt Melting Kettle

The construction and performance features are: Melting tank of 10 gauge, furnace shell of 12 gauge steel plate—all seams double arc welded and tested. Heavy, perforated steel plate screen in tank; barrel grid welded to it; combination 4 point spiral spring and shock absorbers cradling kettle. Chassis 3 in. by 5 lb. channel iron, double arc welded at joints; forged wrought iron pulling eye welded to chassis; axle of 1⅞-in. diameter heavy steel; roller bearing steel or rubber tired wheels—hubs have large grease reservoirs fed from lubricating cups. Heat guards and aprons of sheet steel bolted to chassis furnished with rubber tired wheels. Fuel tank of seamless pressed steel, bottom inserted, interlapped and brazed, tested at 300 lb. hydrostatic pressure. Made like an acetylene cylinder. Hand Pump—2 in., made of heavy brass; 6-ft. length of special oil resisting interwoven hose with ground brass unions; and the Hauck Straight Flame Burner. Heater coils made of dead, soft, annealed, seamless steel tubing, pickled to remove scale. Any single part of burner can be quickly replaced, i. e., a heater coil in 5 minutes, whenever necessary. Burner suspended from "slide-rail," providing heat control. For full heat burner is pushed forward on "slide-rail"; for less heat burner is pulled away from furnace. Made in 50 and 100 gal. sizes with steel and rubber tired wheels.

New Plymouth Gasoline Locomotives

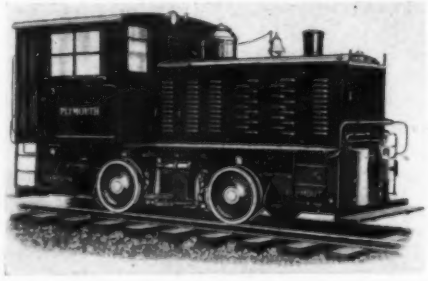
The Fate-Root-Heath Company, Plymouth, O., has brought out a new line of gasoline locomotives known as Model ML6 in three sizes—20, 25 and 30 tons, and Model ML8 in two sizes—30 and 35 tons.

The Model ML6 is powered by a 6-cylinder Le Roi engine, while the ML8 is equipped with an 8-cylinder V-type Le Roi engine. The latter is stated to make an exceptionally powerful locomotive where speed, as well as power, is an important factor.

The frame is a patented bar-steel type of special construction so as to use equalized semi-elliptic springs to the best advantage. This type of frame eliminates many parts that are ordinarily bolted to the frame, providing easy accessibility to all parts inside of frame.

The springs are long and flexible, being 48 in. long and 4½ in. wide.

A new and special feature of this locomotive is that it is equipped with both side and cross equalizers, giving



Model ML6 and ML8 30-Ton Locomotive

a true 3-point suspension, making it easy riding on the roughest track.

A new and improved clutch, that is removable without moving the engine or transmission, is used. The size has been increased to 16 in. in diameter, with six facings for the 6-cylinder and eight faces for the 8-cylinder engine.

These models are now equipped with two large 12-volt starters, direct-driven air compressor and many other improvements giving greater efficiency and durability.

Trackson-Wehr Grader Changed

The Model LHA Trackson-Wehr unit claims economy, adaptability and dependability for road maintenance and construction work.

This outfit is a combination of a crawler tractor and a one-man grader, both of which are known for their performance. With the increased power, traction, and sure footing provided by the Trackson-McCormick-Deering, the grader is able to handle the toughest highway jobs in very difficult conditions. Ditching, crowning, and finishing new roads, re-conditioning and maintaining

New Model Trackson-Wehr Grader

old ones, building sub-grades for paved city streets, breaking up and removing snow, etc., are some of the jobs that can be handled with a Trackson one-man grader unit at low cost.

Economy in the low cost of operation and maintenance and the simplicity of what few repairs may be necessary is claimed by the manufacturer. The Trackson-Wehr unit is economical because it is useful the year around and because the grader is readily detachable from the tractor, so that the latter may be used for drawbar and other general utility purposes.

Highway officials, contractors, park, cemetery, and golf course superintendents, and industrial concerns who build and maintain their own roads will find the one-man grader suited to their purposes. Complete information may be obtained from the Trackson Co., Milwaukee, Wis.

A New Dirt Moving Machine

Among the new exhibitors at the recent Atlantic City Road Show whose display attracted considerable interest was that of Shaw Excavator & Tools Co., Worthington, O. Their space featured the Shaw "True-Cut" Scraper—a two-wheeled design which may be coupled to any tractor of the "caterpillar" or crawler type. It's exceptionally rugged construction and simplicity of design, together with the unique method of operation, received much favorable comment.

Inspection of the 4-yd. model displayed showed that 13-in. ship channel steel comprised the frame construction and that the two heavy wheels with 14-in. tread provided ample traction.

Outstanding among its various features is the fact that the scraper is controlled entirely by one man from his driving position on the tractor. Operation of the bucket from digging to carrying to dumping and spreading positions is controlled from the tractor by means of a winch mounted on the rear end of the tractor. Noticeable among the construction features is the absence of gears, sprockets, rope connections or small moving parts. The cutting edge of the bucket is a detachable, reversible and adjustable high carbon steel knife. The bucket may be adjusted to cutting depths up to 8 in. The Shaw "True-Cut" digs, loads, hauls, dumps and spreads in a continuous operation.

Gardner-Denver Announces Compressor

A new two-stage air compressor of the vertical tandem type, known as the ABA, was placed on the market this month by the Gardner-Denver Co. from their plant at Quincy, Ill.

The new compressor is a simple, sturdy and dependable machine. It weighs 350 lb. and will produce a continuous flow of 24 cu. ft. of air per minute at pressures up to 500 lb. The low pressure head, high pressure cylinder and inter-cooler are combined in a single casting. This simplified construction reduces the number of parts to the minimum and eliminates the usual complicated system of jacket and air piping. Main bearings are of the Hyatt roller type. Lubrication is positive and automatic, being effected by a combination oil pump and splash system.

The ABA compressor can be furnished with pulley for V-bolt drive or for direct connection or electric motor, steam or gas engine. It is particularly

The Shaw "True-Cut" Scraper in Spreading Position

Gardner-Denver 24-Ft., 500-Lb. Compressor

suited for oil and gas engine starting and other services requiring small volumes of air at moderately high pressures.

The Gardner-Denver Co. manufactures air compressors, slush and mud pumps, high pressure drill steel forges, drill sharpeners and rock drills. Its two other plants are located in Denver, Colo., and LaGrange, Mo.

Black and White Prints Made Direct from Tracing

A simplified rapid process for making black and white positive prints or reproductions direct from a tracing without the aid of a negative has been developed by Charles Bruning Co., Inc., 102 Reade St., New York, N. Y.

The process is as simple and rapid as blue printing. The "BW" continuous developing apparatus is attached to a Pease continuous blue printing machine and the operation of printing and developing continuous yardage proceeds the same as in blue printing.

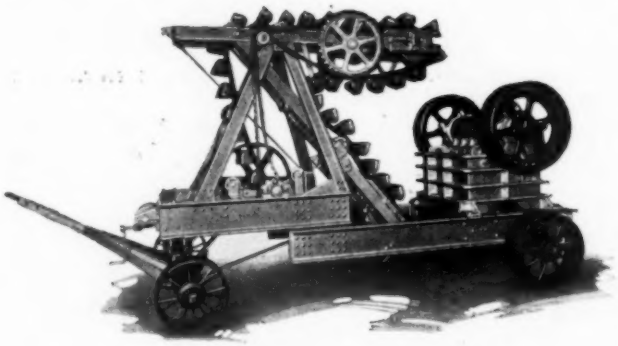
"BW" sheet jobs are likewise handled in the same manner as sheet blue printing, the printing being done on a blue print machine (any make), while the developing is accomplished with a sheet developer.

Any tracing or drawing made on transparent paper or cloth may be reproduced by the "BW" process in the same or less time than it requires to make blue prints. "BW" prints may be efficiently produced out in the field by using a sun frame for printing and a "BW" portable developing machine for developing.

Rear View of "BW" Developing Machine

Wheeling Portable Crushing Plant

A portable crusher with bucket elevators, designed particularly with the idea of easy transport or portability in mind, has been brought out by the Wheeling Mold & Foundry Co., Wheeling, W. Va. The truck wheels are equipped with roller bearings and the wheels have extra wide tread and large diameters so as to permit easy moving in soft material with the available power unit.



The Wheeling Portable Crushing Plant

The frame is exceptionally heavy and consists of 12-in. channels, and directly under the crusher the frame is reinforced with double channels. The bucket line consists of exceptionally heavy steel chains and heavy buckets with four take-up bearings, two at each end, to provide for adjusting. The bucket idlers are properly spaced for smooth operation. The driving chain for the bucket line is provided with a suitable adjustable idler in order to take up any play in this drive chain.

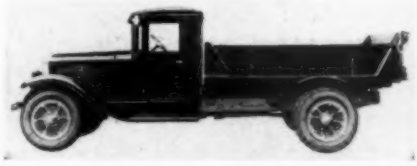
The crushing unit on this portable is the Wheeling 9x36 roller bearing consumption. A number of these portable crushing outfits are stated to be in actual service producing 500 to 600 yd. a day, on 40 per cent crush, reducing ordinary gravel to 1 in. ring size. For this production a 15-30 McCormick-Deering engine has been found ample, with power to spare.

The Wheeling roller-bearing reduction crusher has been particularly designed to meet the present-day operating conditions. On account of the careful consideration given the motion of the Wheeling crusher, at the bottom of the jaw, the percentage of over size returned from the screen is almost negligible. The crusher has been designed with a true forward movement of the movable jaw plate, thus avoiding any tendency for rocker action.

The application of roller bearings has made it possible to increase the speed of these crushers, thus increasing capacity. Increasing the speed of the crusher has made it necessary to change the curvature of the jaw plate as it is a well known fact that too much curvature and speed will cause the rocks to slip or belch out of the crusher, thus cutting down capacity. The special jaw plate design has enabled the manufacturer to utilize this increase in speed and, at the same time, avoid any tendency for the rocks to slip and belch.

New International Model A-5 3-Ton Speed Truck

The new 3-ton speed truck, Model A-5, recently announced by International Harvester Co., Chicago, is designed and built to meet a wide range of hauling requirements. This model incorporates many refinements and features that contribute to improved performance and operating economy.



New International 3-Ton Truck Equipped with Dump Body

The 3-ton Model A-5 is built in four wheelbases—156 in. for dump and semi-trailer service, 170, 190 and 210 in. for general hauling of all kinds. The longer wheelbases provide for maximum body lengths (back of cab) as follows: 170, 190 and 210-in. wheelbases; 13 ft., 15 ft., and 17 feet. 6 in. respectively. Two and one-half-yard dump bodies of 9 ft. or 9 ft. 6 in. in length may be mounted on the 156-in. wheelbase chassis.

Outstanding among the features of this new International are the new 6-cylinder engine with its 7-bearing crankshaft, 7-bearing camshaft, and removable cylinders; the single-plate clutch with built-in vibration damper; a new and exclusive transmission with five speeds forward and one reverse; new spiral bevel gear drive axle; the latest type mechanical 4-wheel brakes; heavy pressed-steel channel tapered frames, and others of equal importance.

DISTRIBUTOR NEWS

The Distributor's Department in the Gillette Construction Group

Snap Shots from the Road Show

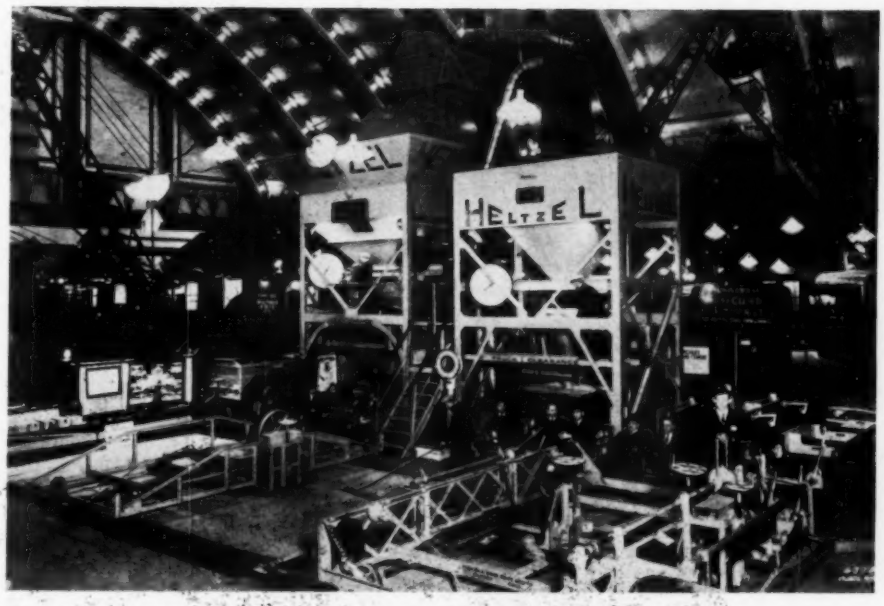
After the Road Show is over those of us who were there look over the pictures and say "Yes, that's just the way the booth looked, it was a fine exhibit." And those of us who had to stay at home to poke the furnace fires, look at the picture and say: "It looks like a fine booth, wish I'd been there."

Several very attractive views of booths at the 1930 Road Show have been sent in to Distributor News and we take pleasure in presenting them to our readers.

* * *

Among the exhibits of accessories to road building equipment, that of the Servicised Products Corporation was one of the most interesting. Aside from the familiar types of expansion joint filler, pressure produced from fibrated asphalt, there were shown various types of premoulding rail filler, which is a cushion used between the rails and pavement at crossings and on streets in which tramways are constructed.

Another interesting item was a complete full-sized section showing highway crossing using the rail filler just mentioned and 2-in. asphalt planking made up so that ordinary labor could remove the sections and put them back again at such time as necessary to retamp or regrade tracks.



General View of Heltzel Exhibit

Other items of premoulded material shown in special shapes in the Servicised booth were wall coping, conduit for signal wires, industrial flooring, waterproofing protection course, and sewer joint and calking material. The entire booth was decorated with draperies and a profusion of plants and flowers, and the comfortable resting places made it a pleasant place to visit.

* * *

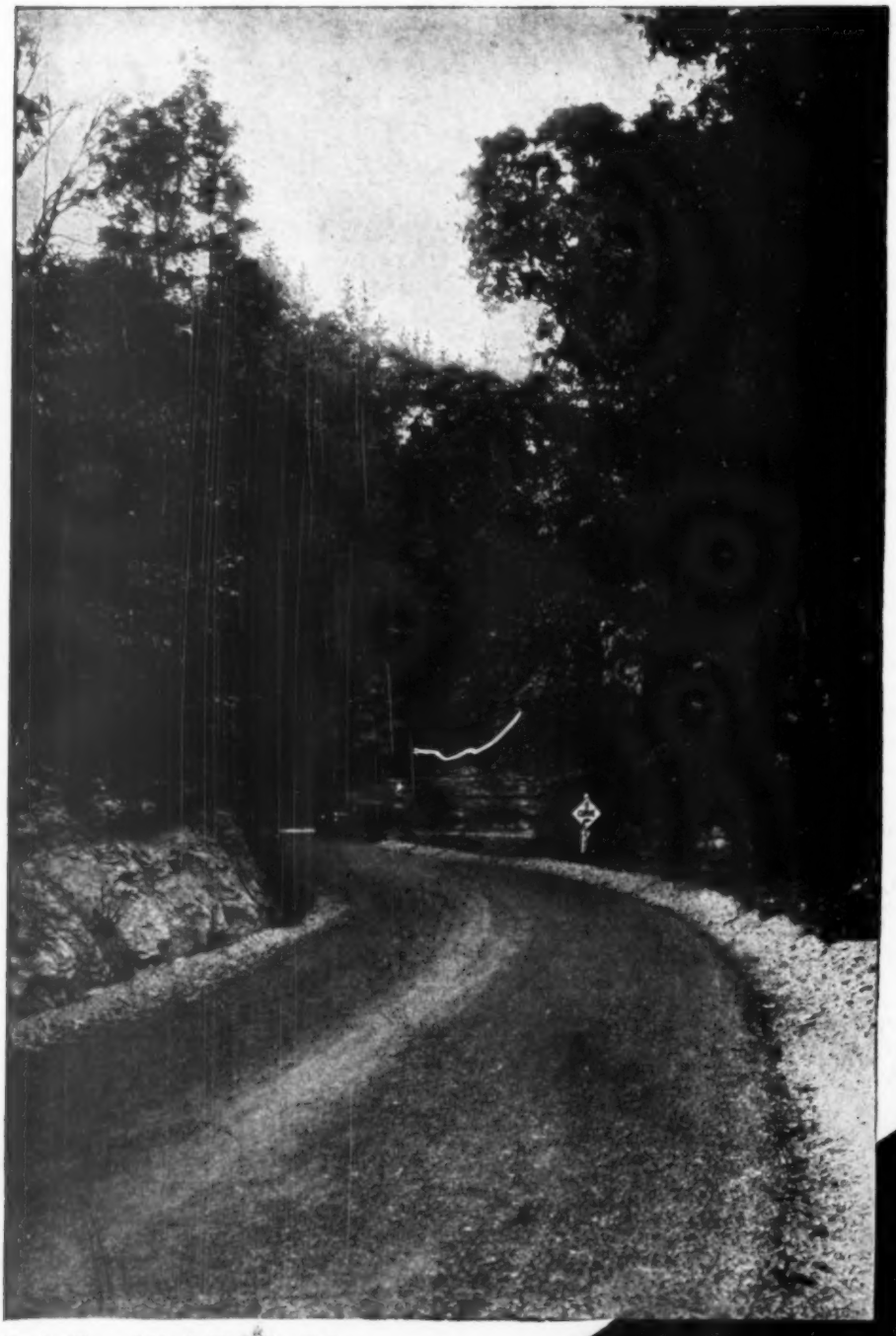
Another very interesting exhibit was that of the Heltzel Steel Form & Iron Company, Warren, O. A section of concrete road, 16 ft. wide and 40 ft. long, with a 6-in. slab, was built in the booth, showing the Heltzel Superior Lock Road Forms in place. A Flex-Plane Mechanical Joint Machine and a Cleft-Plane Joint Machine were in constant operation on this road section.

Two of the Heltzel trailer type portable bins were exhibited. One of these was a two compartment sand and stone bin of 65 tons' capacity, equipped with a Heltzel duplex weighing agrabatcher, which utilizes a specially built springless dial type of scale. Sand and stone were weighed in full-sized batches all during the show. More than 2,000 tons of aggregate were batched during the show.

The other Heltzel bin exhibited is designed for the handling of bulk cement, the outstanding feature being its portability. The plant exhibited has a capacity of 125 bbl. of cement, equipped with dustless cement weighing agrabatcher, using an automatic springless dial scale having a dial 36 in. in diameter, graduated from 1 to 1,000 lb. in single pound graduations.

Other items attracting attention to

Servicised—A Good Place to Stop



Louisville and Nashville Pike, U. S. Highway No. 31 West, Tennessee. Tarvia "Re-Tread."

The Barrett Company

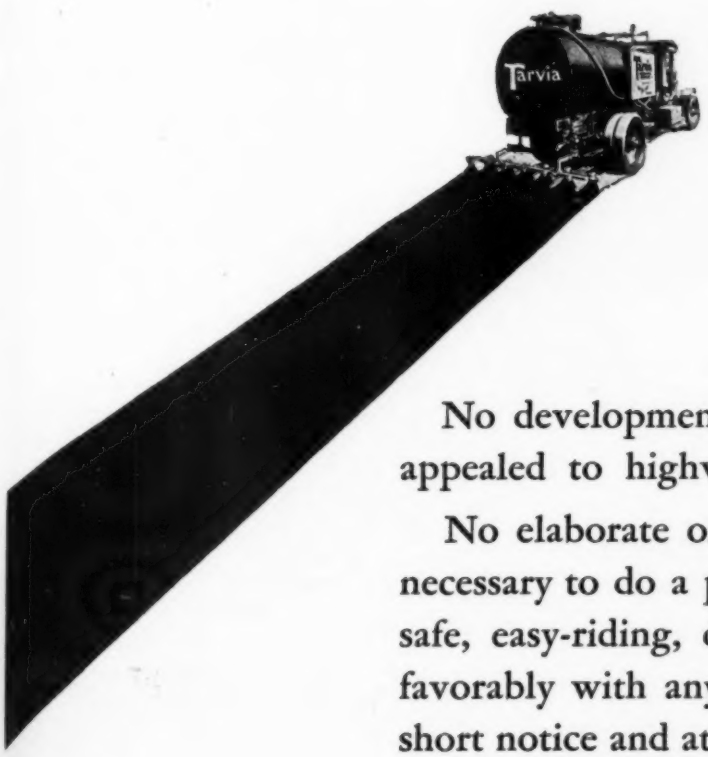
New York	Chicago	Philadelphia
St. Louis	Minneapolis	Boston
Detroit	Cleveland	Birmingham
Buffalo	Columbus	Milwaukee
Providence	Syracuse	Cincinnati
Baltimore	Toledo	Rochester
Lebanon	Youngstown	Bethlehem
		Hartford

In Canada:

THE BARRETT COMPANY, Ltd.
Montreal, Toronto, Winnipeg, Vancouver

Do you mention ROADS AND STREETS when writing? Please do.

Makes a little ROAD MONEY *work like a* LOT



No development of recent years has so universally appealed to highway officials as Tarvia "Re-Tread."

No elaborate organization or expense equipment is necessary to do a perfect job with "Re-Tread." A skid-safe, easy-riding, durable road surface that compares favorably with any type of pavement can be built on short notice and at exceedingly low cost.

Tarvia "Re-Tread" is a mixed-in-place combination of crushed stone, slag or crushed gravel and a special Tarvia developed particularly for this method. On any strong road base, new or old, "Re-Tread" provides a pavement that is completely satisfactory to road officials, taxpayers and motorists.

The Tarvia field man will gladly tell you more about "Re-Tread." Phone, wire or write to our nearest office.

Tarvia "RE-TREAD"

TRADE MARK REG. U. S. PAT. OFF.

At the "Good Roads Machinery Booth"

the Heltzel booth were steel forms for curb and gutter, integral curb and base, lip curb, sidewalk construction, steel bulkheads, etc.

* * *

One of the interesting features of the exhibit of the Good Roads Machinery Company of Kennett Square, Pa., was the manner in which the No. 1030 Crusher was displayed. The shining white enameled crusher was mounted on a platform raised 26 in. above the main floor. Mirrors were placed underneath and so arranged that on standing at the front or back of the crusher and looking down into the mirrors one could observe all the movements of jaw and toggle from below. The crusher was kept running at normal speed (300 r.p.m.) and was examined by many hundreds of visitors during the show.

Other equipment displayed by Good Roads Machinery Company included 3 cu. yd. RMC Carriers, mounted on a 5-ton Autocar chassis, equipped with Heil Hydraulic Dump Hoist. This truck was also equipped with Model 25 reversible blade snow plow, with Westinghouse pneumatic lifting device. The plow equipment could be operated from the driver's seat in the truck cab.

Then there was the "Autograder" equipped with rubbered-tired wheels, scarifier, etc., and the new "Dreadnaught" power grader which received many "return" calls.

The entire engineering staff, factory foremen and other members of the "Good Roads" family, attended the show and voted it a great success.

Oriental Trade Picks Up

With the reawakening of trade in the Orient, the American Bosch Magneto Corporation is finding a wide outlet for all its automotive products there, magnetos and coils especially having a gratifying and constantly growing acceptance, according to information recently received from this company.

China is proving a particularly promising field for American Bosch automotive products, it is said, and distributors located in Hankow, Canton and Peiping (formerly Pekin) have found it necessary to open additional distribution channels through their branches in Shanghai, Hongkong, Harbin, Dairen, Mukden and other larger centers. Other Oriental distribution points which are operated from the Pacific Coast Division of the American Bosch Magneto Corporation, are Osaka and Tokio in Japan; Manila and Honolulu. Further, the West Coast of Mexico also shows a decided interest in American Bosch automotive products, and an expansion of the company there is under progress, according to announcement.

That the development of export trade will aid materially in balancing production in the United States and is the solution to the problem of how to absorb excess production and maintain low costs, is the opinion expressed by Julian L. Deane, sales promotion manager, and is also given as the reason why American manufacturers are giving increased attention to export outlets for their products.

Announcement

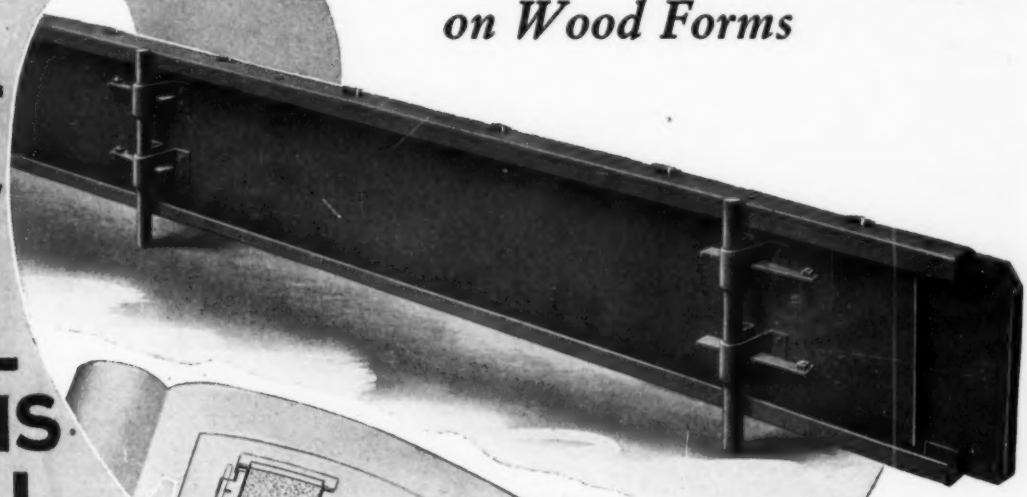
Mr. W. Earle Pashley, advertising manager of the C. F. Pease Company, 813 N. Franklin St., Chicago, Ill., has been appointed assistant sales manager and second vice-president. Simultaneous with that appointment Mr. Pashley was elected to the board of directors and in addition to his new responsibilities will continue in charge of advertising and all promotional activities of the company.

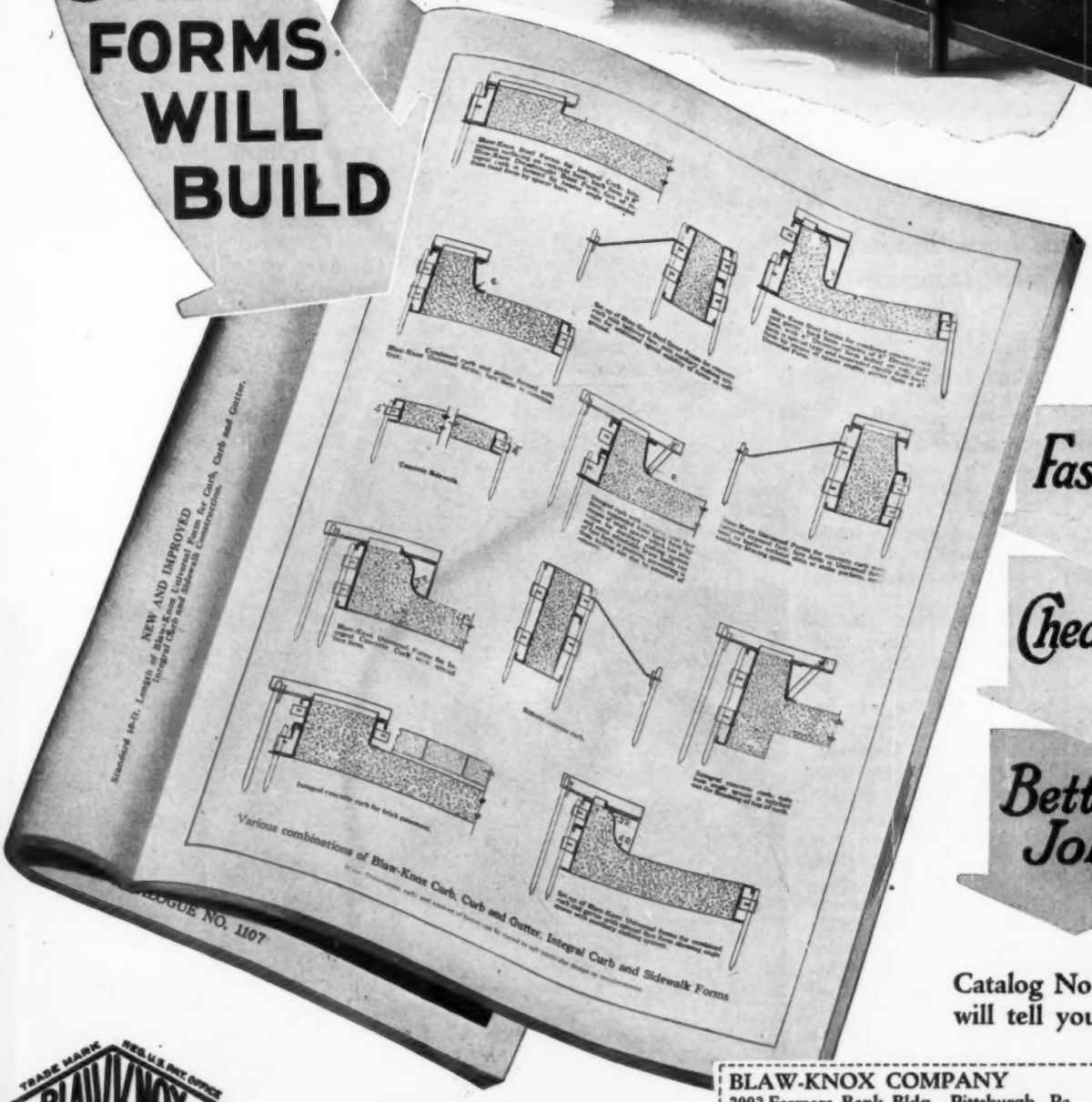
Nothing Small About Cleveland

"Cletrac" made an impressive showing and the Cleveland Tractor Company of Cleveland (the town of former Road Shows) was kept busy entertaining visitors who wanted to "look 'em over."

A SET OF BLAW-KNOX STEEL FORMS WILL BUILD

—too much money is wasted on Wood Forms





Faster

Cheaper

Better Jobs

Catalog No. 1107 will tell you how

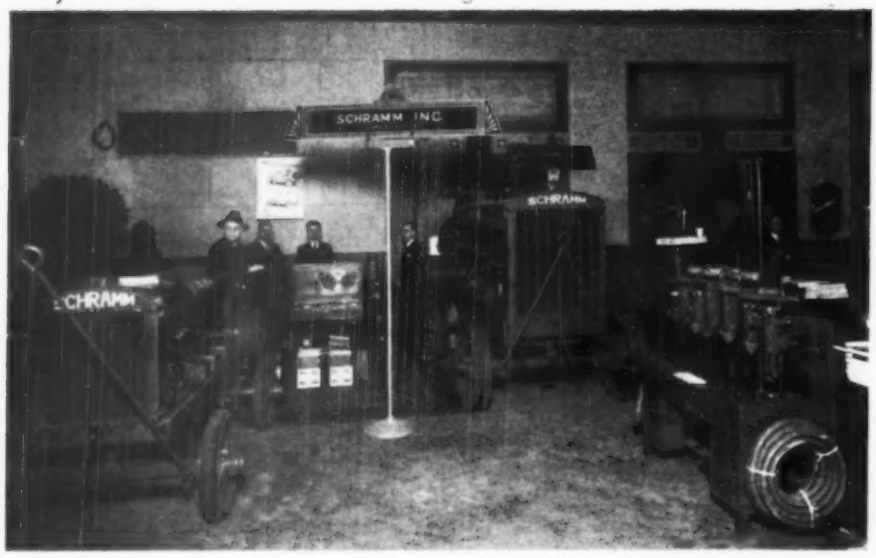
TRADE MARK REG. U.S. PAT. OFFICE
BLAW-KNOX

BLAW-KNOX

BLAW-KNOX COMPANY
2003 Farmers Bank Bldg. Pittsburgh, Pa.

Send me a copy of your Bulletin No. 1107 —Blaw-Knox Street and Sidewalk Forms.

NAME .....
COMPANY .....
STREET .....
CITY ..... STATE .....



Our Neighbor

Schramm, Inc., of West Chester, Pa., was the next door neighbor of the publishers, presenting exhibitions of the "last word in air compressors." If we are not mistaken, the genial host of the booth, Mr. W. O. Witt, is standing second from the left.

News Items from Universal Atlas Cement Company

New appointments in the Universal Atlas Cement Company, a subsidiary of the United States Steel Corporation, have been announced by B. F. Affleck, president, following the joining of the Universal and Atlas organizations.

E. D. Barry, superintendent of the plant at Universal, Pa., has been appointed assistant operating manager, with offices in Chicago. Mr. Barry is a graduate of the Massachusetts Institute of Technology. He has been connected with Universal for more than 25 years.

Leonard Wesson, assistant general Superintendent, Atlas division, has been made assistant operating manager, with headquarters in Chicago. In his new position Mr. Wesson will return to familiar ground, as he was formerly a member of the Universal organization. He has had more than 20 years' experience in the cement industry.

J. C. Witt, chemical engineer, has been transferred from the Buffington, Ind., plant to Chicago. He is a graduate of Butler College, of the University of Chicago and of the University of Pittsburgh, taking his doctor of philosophy degree at the latter institution. For three years he was engaged in chemical research for the Portland Cement Association and is the author of many articles on the subject. Mr. Witt has been with Universal since 1924.

T. A. Hicks, general chemist, Atlas division, was appointed to the same position with the new company, with offices in Chicago. For many years Mr. Hicks was associated with the Atlas company and has high standing in the technical and engineering world.

R. L. Slocum, who hitherto was assistant superintendent at the Universal, Pa., plant was made superintendent. He is a graduate of Pennsylvania State College and was connected with the Carnegie Steel Company, another subsidiary of the steel corporation, until he came to Universal. Last year he was awarded the Judge Gary medal for 25 years' continuous service.

H. H. Lauer, engineer, Atlas division, who was appointed assistant chief engineer, Chicago, has been with the Atlas company several years. Previously he was connected with the Illinois Steel Company and related industries and has had extensive experience in the engineering field.

"All the appointees have demonstrated ther fitness for their new positions by their previous records," said Mr. Affleck. "Their ability and experience will help to insure customers of the Universal Atlas Cement Company the same efficient and satisfactory attention they formerly received from the two separate companies."

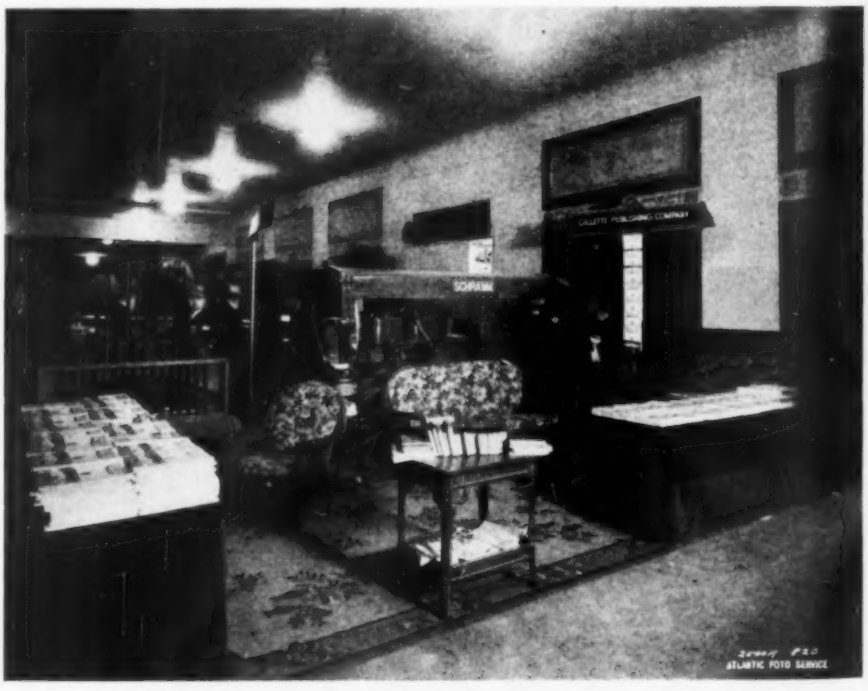
Wood Hydraulic Purchases Hydraulic Hoist Co. of St. Paul

Of general interest to the trade is the announcement that the property and assets of the Hydraulic Hoist Manufacturing Company, St. Paul, Minn., builders of the well known "St. Paul Hoist," have been purchased by the Wood Hydraulic Hoist & Body Company, of Detroit, Mich.

Wood Hydraulic Hoist & Body Company announces that the business of the Hydraulic Hoist Manufacturing Company will continue under the same management and St. Paul hoists and bodies will be marketed through the same dealer organization, who have so successfully handled St. Paul hoists and bodies in the past.

Plans are in effect to build a body plant at St. Paul or Minneapolis to take care of the requirements for bodies specified for shipment with hoists out of St. Paul.

The name of the company has been changed to St. Paul Hydraulic Hoist Company.



Just Us in Good Company

Never would we dare to show ourselves, but for the fact that we were in such good company. Our nearest neighbor, Schramm, is shown right "on the job" and but one step farther on is Truscon Steel Company.

SERVICE
That Means Something

FEW companies in the world can display the enormous repair stocks ready for shipment, the modern plant covering 73 acres which devotes its entire energies to a single industry and the large number of creations of designs and features that benefit the entire industry as can Marion. This is service that is built into the product, developed within the plant and trained in the individuals of the Marion organization.

▼

MARION

3

THE MARION STEAM SHOVEL CO.
MARION, OHIO, U. S. A.

REPRESENTATIVES: Atlanta, Bangor, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Dallas, Detroit, Huntington, Indianapolis, Jackson, Kansas City, Los Angeles, Lexington, Ky., New Haven, Newark, New York, Philadelphia, Pittsburg, Kan., Pittsburgh, Pa., Portland, St. Louis, St. Paul, San Antonio, San Francisco, Seattle.

SERVICE EXCHANGE
For
Manufacturers or Distributors

Editor's Note.—From time to time we receive letters from distributors wishing to be put in touch with manufacturers of certain lines of equipment, or from manufacturers seeking representatives for their products. Items of this kind will be published and names and addresses furnished interested persons upon request.

New Lines Wanted

Distributor thoroughly familiar with bituminous materials and equipment for handling, wishes to add to present lines. Covers Wisconsin and Illinois territory.

Canadian distributor of equipment for water softening, filtration, sewage purification and pumping is interested in securing exclusive sales rights for kindred equipment in the Dominion.

Distributor covering New Jersey and New York territory would like to secure a line of street markers or other traffic equipment on exclusive basis.

Equipment distributor in Pacific Northwest desires line of road building equipment, structural building equipment, dump bodies and truck hoists.

Distributors of contractors' and builders' machinery and equipment are seeking line of road forms, road finishers, batcher plants, clamshell buckets and drag line buckets, for northern California terirtory. Now stocking equipment for several well known machinery manufacturers.

Manufacturers' agents representing well known lines of water works equipment desire to secure line of pipe pushers and other similar equipment for California and western Nevada territory.

Road machinery distributor would like to secure exclusive sales rights for state of Mississippi for line of automatic or self-loading wheeled scraper.

A Michigan distributor, with many years' experience, representing at this time prominent manufacturers of pumping machinery, offers the services of an established representative to manufacturers needing increased facilities in this region.

Manufacturers' representatives located in New York would like to add line of heavy contractors' equipment of established reputation, other than the lines now handled by them. They would like exclusive sales rights for such equipment.

Equipment distributor located in Michigan desires to add two or three good lines to serve territory in southeastern part of state.

Wanted for Buffalo, Niagara Frontier and Western New York territory a good power and heating boiler account.

Distributor of building specialties covering a territory of 100 mile radius from Chicago is equipped to represent additional lines.

Machinery distributor established in Porto Rico and Santo Domingo would be pleased to make arrangements to take on new lines in these territories.

Machinery company in the east is interested in representing established lines of road machinery, with the exception of graders.

Representatives Wanted

Manufacturer of Transverse Testing Machines desires to build up distribution organization in this country and abroad.

Manufacturer of plows, grade-rippers and scrapers desires representation in Arizona, New Mexico, Arkansas, Kansas and Louisiana.

One of the leading manufacturers of surveying instruments in the United States is seeking responsible agents in all sections of the country. Instruments are nationally advertised in all leading engineering journals.

Manufacturer of paving expansion joints is seeking distributors and manufacturers' agents in good, unassigned territory.

Manufacturer of air compressors and contractors tools has number of desirable territories open. Full co-operation will be extended to distributors.

Manufacturer of patented reflecting signs and devices desires representative for New York City, Long Island, Westchester County and adjacent territory. Some one selling other products to municipalities preferred.

District representatives wanted for sanitary engineering specialty used extensively in the water works, sewage and swimming pool fields.

Manufacturer of patented luminous highway danger signs and signals is interested in securing aggressive representation in various parts of this country and Canada.

Manufacturer of non-clogging sewage pumps, both horizontal and vertical, as well as water works pumps suitable for municipalities of 50,000 or 60,000 people, is interested in securing additional sales representation.

Well established manufacturers' representatives wanted to handle sand and gravel pumps and equipment, in key cities, by successful manufacturer of high grade dredging pumps and hydraulic dredging equipment. Give character of equipment now being handled and territory covered.

Manufacturer of hoisting machinery and air compressors has open territory in New York and New England states for aggressive distributor.

Distributors wanted for deep-well turbine pumping unit. Product serves small industrial plants, private estates and farmers.

Manufacturer of water works brass goods would like to make proposition to manufacturers' representatives calling on water works' trade.

Attractive territory available for experienced men to handle contractors' labor-saving equipment by old established company. Equipment backed by national advertising.

A manufacturer of paving expansion joints is looking for distributors for northern California territory.

Manufacturer of metal lath, corner beads, channels and reinforcing mesh desires to secure distributors for products in the southwest and middlewest.

Manufacturer of threadless pipe couplings and tees, with rapidly growing business, is seeking additional representatives.

Manufacturer of metal tie and spacer wishes to establish distributing points throughout the country.

Manufacturer of mechanical spreaders for cover material desires representation by organizations covering entire states. Several desirable states are still open. Number of inquiries now on hand for spreaders require immediate follow up.

Manufacturer of complete line of construction equipment, mixers, saw rigs, plaster and mortar mixers and pumps has an open territory in the state of Maine and is looking for an aggressive distributor to represent him there.

Long established and well-known manufacturer of industrial locomotives wishes to make contacts with qualified distributors. Locomotive line includes steam, gasoline, gas-electric and oil-electric. Supported by national trade journal advertising.

ORTON Model 15 Crane and Shovel

A completely convertible 1¼-yard crane, shovel, dragline and ditcher built for the heaviest excavating and material handling.

Alloy-steel shafts and gears with electric-welded base combine to make it the most modern high-speed excavating machine on the market.

ORTON CRANE & SHOVEL CO.
608 S. Dearborn St., Chicago, Ill.
Representatives in Principal Cities

Worm operated, non-reversing boom hoist.

Four-speed, heavy, automotive-type transmission, with gears constantly in mesh.

Operator's position clear out in front.

Large-pitch, oversize, alloy-steel swinging gears. Independent "V" type swinging clutches. Entire clutch shaft and vertical shaft removable in one unit.

Unit-structure base completely electric-welded.

A. E. D. Elects New Officers for 1930

The Associated Equipment Distributors at their annual meeting, held in Atlantic City in January, elected the following officers to serve the organization during 1930:

President—A. A. Fuchs.
First Vice-President—N. Floyd.
Second Vice-President—O. B. Bjorge.
Secretary—A. C. Blaisdell.
Treasurer—H. W. Fletcher.
Directors—D. R. Brown, E. K. Hurst, M. R. Hunter, M. Kaplan, E. R. Rausch, T. W. Rosholt and Vic. L. Phillips.

Mr. A. A. Fuchs is one of the active workers of the association and president of Fuchs Equipment Company of Omaha, Neb. This company is one of the largest distributors in the middle west, and the A. E. D. considers itself fortunate in securing Mr. Fuchs as the president for the coming year.

H. W. Fletcher

M. R. Hunter

D. R. Brown

Mr. Nick Floyd is a member of the Hubbard-Floyd Company, New York City, one of the prominent distributing organizations in the eastern territory. Mr. Floyd has been a conscientious worker on A. E. D. problems and it is said that his task during the past year—that of compiling the new A. E. D. catalog—has been no easy one. This catalog is now being printed by Riverside Press, New York.

Mr. O. B. Bjorge, sponsor of problems regarding the protection of association members in reference to insurance and various other knotty questions of similar nature, is one of the executives of the Clyde Equipment Company, Portland, Ore.

A. A. Fuchs

N. Floyd, Jr.

O. B. Bjorge

The secretary, Mr. A. C. Blaisdell, has held this office for a number of years without remuneration. The association feel particularly grateful to Mr. Blaisdell for his efficient services, which entails considerable work and much time.

E. K. Hurst

A. C. Blaisdell

Mark Kaplan

The treasurer, Mr. H. W. Fletcher, is a former president of the association. Mr. Fletcher is treasurer and general manager of the Clyde Equipment Company of New Orleans, La. He is evidently able to supply his associates in the A. E. D. just what they want, for one of them has said "he is the cream in our coffee."

Listed among the directors are found the names of many distributors, recognized as active and successful leaders in the construction equipment field. Included among them are D. R. Brown of Brown-Bevis Company, Los Angeles, Calif.; E. R. Rausch of George F. Smith Company, St. Louis; Thorman W. Rosholt of Thorman W. Rosholt Company, Minneapolis, and last, but not least, Mark Kaplan of the Superior Supply Co., Chicago, who serves the association as chairman of the Publicity Committee.

Joslin Manufacturing Co. Acquires Graphic Arts Sign Company

Through purchase of the Graphic Arts Sign Co., of Grand Rapids, Mich., by the A. D. Joslin Manufacturing Company of Manistee, two firms well known in the municipal supply business making a complete line of signs and signals have combined, and due to the consolidation it is said that they will be able to offer a wide range of signs to municipalities with an equally wide range of price.

Grand Rapids equipment of the Graphic Art Signs Company will be transferred to Manistee, where the products will be manufactured and the trade name will continue in use. These products are baked enamel steel signs, whereas the line of the Joslin Company is aluminum. The fact that the steel type of signs made by the Graphic Arts Co. are durable and less expensive than the aluminum signs produced by the Joslin Company will furnish facilities for producing products to meet the needs of municipalities at any given price.

The company reports a very satisfactory volume of business for 1929, showing an increase of 25 per cent over 1928, which in turn was 20 per cent over the business of 1927. The market demands are stabilized throughout the year and unaffected by seasonal influences. In addition to the domestic trade, the Joslin Company finds a considerable outlet for their products in China, Japan, Africa, Australia, European countries and Mexico.

SPEEDER

TRADE MARK. REG. U.S. PATENT OFFICE

7 months
5 "

year 'round work.
mid - January
a frozen quarry
a Speeder Model B-3 Shovel
with Speeder semi-missabe bucket
a winter contract
YEAR 'ROUND PROFITS.

YOU'LL BE INTERESTED IN THIS.

Have you read about the Speeder Model 90 of 1¼ yards capacity? A complete Timken bearing unit built job, 17 inches ground clearance—fast and powerful. A 110 H. P. motor—automotive construction all the way thru. You, who know and own Speeder half-yard machines, appreciate the fine quality built in Speeder equipment. You, who know shovels, will realize a new era in shovel manufacturing is here when you see the Speeder Model 90 — the FULL MEASURE 1¼ yard convertible, friction-free shovel.

Speeder Machinery Corporation

Pioneer manufacturers of full revolving, fully convertible, one-half yard gasoline shovels

1201 South Sixth Street, West Cedar Rapids, Iowa, U. S. A.

National Equipment Corporation Conducts Sales-Service School

Nearly 200 men from all parts of the United States, employed by representatives of the National Equipment Corporation, with headquarters at 30th St. and Concordia Ave., have been attending a sales and service school at the factories of the different divisions.

Plants of the National Equipment Corporation, which manufactures contractors' equipment and construction machinery, are located in Milwaukee, Indianapolis, Newton, Ia., and Port Washington, Wis.

The Milwaukee plants consist of the Koehring Division, manufacturing pavers, mixers, power shovels, pull shovels, cranes, draglines and dumptors; the T. L. Smith Division, manufacturing tilting and non-tilting mixers, pavers and weigh-mix; and the C. H. & E. Division, producers of portable saw rigs, pumps, hoists and material elevators.

The school consisted of two sections, one week for each group, the purpose of which was to train the men in the proper methods of handling the problems incident to the selling and servicing of this line of equipment.

A day and a half by each group was spent at Indianapolis at the plant of the Insley Division, which produces excavators and concrete placing equipment.

Following this the groups spent a day and a half at the Parsons Division, Newton, Ia., which is devoted to manufacturing trenching machines and backfillers.

From Newton, the special car was brought to Milwaukee, where three days were spent at the plants of the Koehring, Smith and C. H. & E. Divisions. The school ended with a banquet at the Schroeder Hotel, at which R. E. Brooks, vice-president in charge of sales, presided as toastmaster.

Sterling Motor Truck Breaks Record

W. B. Hambly, vice-president and general manager of the Sterling Motor Truck Company of California, announces that new Sterling units registered in that state in 1930 exceeds the previous year by 29 per cent. According to Mr. Hambly, this is a record for Sterling in that territory.

The home office and factory of the Sterling Motor Truck Company is at Milwaukee, and of the many factory branches they operate, fourteen are located on the Pacific Coast. Mr. H. C. Keenen, vice-president of the company, has recently announced the appointment of Lewis C. Craig to succeed the late Fred J. Storm, as general manager of the Detroit branch.

Mr. Craig has served as assistant to Mr. Storm since the branch was established. He is well known in Detroit through his association with Sterling and also because of his former connection with Federal. During the war, Mr. Craig established a name for himself in the aviation section of the A. E. F.

The late general manager of the Detroit branch, Mr. Fred J. Storm, died a few weeks ago following a brief illness. Mr. Storm had held executive positions with several prominent Michigan concerns and was well known in automobile and financial circles.

"School Boys"
National Equipment Corp. representatives at Sales and Service School.

Warco Announces Sale of Little Rock Branch

The sale of the North Little Rock Branch of the W. A. Riddell Company to the Southwestern Equipment & Supply Company, Market St. and Broadway, Little Rock, Ark., has just been announced.

The North Little Rock Branch has been under the managership of Mr. O. F. Tapley for the past several years. The sale involves all of the physical equipment of the Branch as well as exclusive sales right of WARCO equipment, including power and drawn graders, wheeled scoops and rear-type crawlers for tractors in the state of Arkansas.

The Southwestern Equipment & Supply Company is a new organization, under the management of Mr. T. B. Cooper, who has a wide acquaintance in the road machinery field. Mr. Cooper will continue the unique selling plan which was inaugurated by the North Little Rock WARCO Branch in that graders will be carried on a big trailer truck direct to the county or township desiring a demonstration of road building machinery. The grader will be unloaded right on the job and an actual demonstration of its performance given in the work which it is expected to do. This method has been used with unusual success and will be continued under the direction of Mr. G. C. Merriman, who was formerly with the WARCO Branch.

Mr. O. E. Tapley will continue in the employ of the W. A. Riddell Company, serving as a field representative for the southwest, including Arkansas and adjacent territory.

E. D. Sirrine Becomes Autocar Executive

Mr. H. M. Coale, vice-president in charge of sales of The Autocar Company, motor truck manufacturers, announces the appointment of E. D. Sirrine to the position of transportation engineer on the Autocar headquarters staff.

Mr. Sirrine's services will be available to make professional surveys and recommendations concerning transportation problems of business houses whose operations require such studies. He is well known in the motor truck industry and among users of large trucks, and was for some time in charge of the automotive equipment of Borden Farm Products Company of New York, where more than 1,000 motor vehicles were under his direction.

The past experience of Mr. Sirrine includes active connections with the Divco Detroit Corporation, the national account division of the General Motors Truck Company, the White Company and the Timken Detroit Axle Company.

LORAIN 75

IT has been our experience that the more careful a man is in buying a shovel, the more he appreciates the fine job obtainable in today's Lorain 75.

It's just good business to check up on this machine before you make your final selection of a power shovel. The reputation of a contractor is the reputation of his equipment.

THE THEW SHOVEL CO.
Lorain, Ohio

THEW

Edward R. Bacon Company Resumes with Byers Lines

The Byers Machine Company, Ravenna, O., announces the appointment, effective immediately, of Edward R. Bacon as its sales representative in San Francisco and northern California. The Bacon Company will handle the entire Byers' line, including ½ yd., ¾ yd., 1 yd. and 1¼ yd. shovels, cranes, draglines, trenchers and skimmers.

Mr. Edward R. Bacon, President Edward R. Bacon Co.

Unusual interest attaches to this announcement, as the Bacon organization was previously the distributor in northern California for the Byers' line, comprising a continuous connection broken only during the past two or three years.

Replacement parts will also be carried in the Bacon organization headquarters at San Francisco.

New Distributors for Gilbert Graders

Gilbert Manufacturing Company of Stillwater, Minn., manufacturers of push and pull type graders, fresno shoes, mowers, scarifiers, etc., announces the appointment of the following distributors.

The B. Hayman & Company, 118 N. Los Angeles St., Los Angeles, Calif., will handle southern California trade. This company are now distributors for McCormick-Deering tractors, Trackson crawler tracks and other popular lines of road machinery.

The Taylor Tractor & Implement Company, Montgomery, Ala., will handle the entire state of Alabama. They are now representing the McCormick-Deering line as well as a complete line of allied equipment.

New Distributors

The Heltzel Steel Form and Iron Company is pleased to announce the appointment of the following new representatives:

Stuart M. Christhilf & Co., Inc., 205 Snow Bldg., Baltimore, Md.

J. B. Harbison Equipment Co., 209 Spring St., Little Rock, Ark.

Hudson Supply & Equipment Co., Seventh and T Sts., N. E., Washington, D. C.

From the Air

Looking down on the vast acres of Sweet's Steel Company, which utilizes approximately 42 acres for 96 company houses for its workmen. The plant occupies 50 acres and furnishes the railroads with heavy tonnage haulage in the incoming and outgoing shipments of raw materials and finished products. Founded in 1868 by William Sweet, this company now represents an investment of approximately $70,000,000. View shown is the plant at Williamsburg, Pa.

Kratz & McClelland, Inc., 522 Bryant St., San Francisco, Calif.

Banks-Miller Supply Co., Huntington, W. Va.

Crook Company, 1220 S. Grand Ave., Los Angeles, Calif.

The C. H. Jones Co., 134-140 Pierpont Ave., Salt Lake City, Utah.

Waterhouse Equipment Co., Inc., Jackson, Miss.

W. S. Haring Goes to Los Angeles

Mr. Willard S. Haring, vice-president of the Alan Wood Steel Company of Conshohocken, Pa., is now located in Los Angeles in charge of western sales for his organization.

Following Mr. Haring's transfer to the West Coast, the company announced the appointment of Mr. A. L. Meyer as general manager of sales and Mr. W. H. Dickson as assistant general manager of sales.

Mr. Meyer was formerly assistant general manager of sales, and Mr. Dickson held the position of Philadelphia district sales manager.

Mr. Willard S. Haring

W. W. DuPre Acquires Interest in Thomas Brown, Inc.

Wallace W. DuPre, for fourteen years sales manager of the Knickerbocker Company, Jackson, Mich., has purchased a substantial interest in the business of Thomas Brown, Inc., Baltimore, Md., and Washington, D. C., distributors of Knickerbocker concrete, mortar and plaster mixers and saw rigs, Keystone power shovels and Marlow pumps, and will make his headquarters in Baltimore.

According to announcement Mr. DuPre will retain his interest in the Knickerbocker Company, remaining as its vice-president.

Introducing Hercules, Delaware

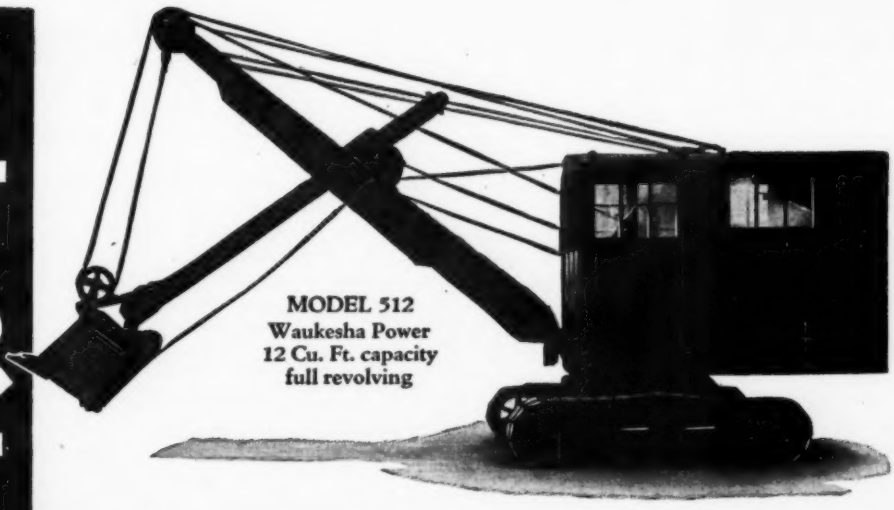
A new freight station on the Landenburg branch of the B. & O. R. R. has been named Hercules. The new station is about five miles from Wilmington, and is marked by a special side track to the new experimental station being constructed by the Hercules Powder Company of Wilmington.

The site for the new Hercules experimental station is practically completed as far as road work on the grounds is concerned and excavating is now starting for the foundation work of the main laboratory building. Other buildings, including several semi-plant units, will be erected prior to the removal of the company's research facilities from Kenvil, N. J., it is announced.

Announcement

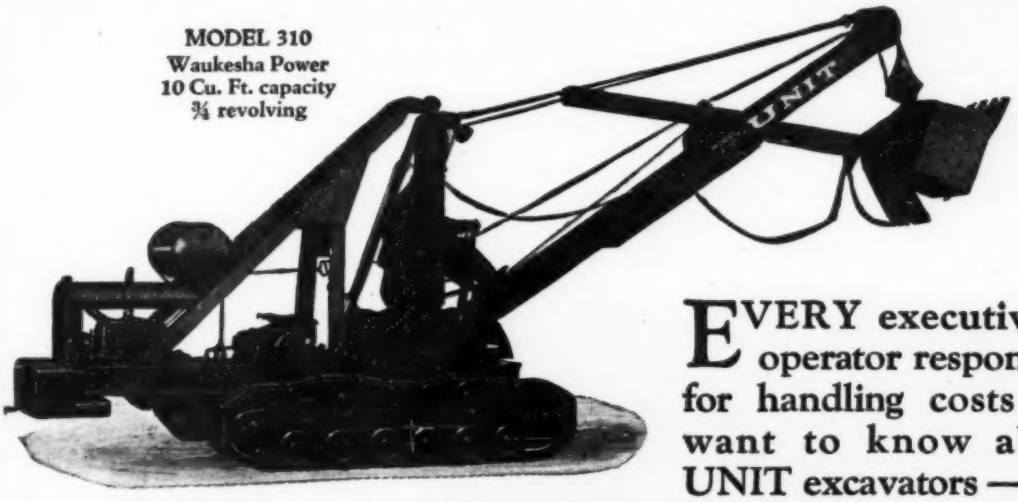
B. W. & Leo Harris Company of Minneapolis announces the purchase of Russell drag, wheel and buck scrapers, road plows, rooter plows, road drags and parts and repairs for these items from the Caterpillar Tractor Company, together with the rights to manufacture them.

CUT YOUR COST OF HANDLING



MODEL 512
Waukesha Power
12 Cu. Ft. capacity
full revolving

USE THESE EXCAVATOR INNOVATIONS



MODEL 310
Waukesha Power
10 Cu. Ft. capacity
¾ revolving

EVERY executive or operator responsible for handling costs will want to know about UNIT excavators — The simplification, long life, standardization, interchangeability, ball bearing and roller bearing mounting of chrome nickel steel, heat treated shafts and gears. UNIT built to do more work for less money. UNIT excavators are quickly interchangeable as shovel, trenchoe, crane, clamshell, dragline or backfiller. Complete information is yours on request.

UNIVERSAL POWER SHOVEL CO.

Division Unit Corporation of America

Bankers Building
Milwaukee, Wisconsin

UNIT

Sivyer and Nugent Foundries Combine

The directors of the Sivyer Steel Casting Company, Milwaukee, and the Nugent Steel Castings Company, Chicago, have announced the consolidation of their companies. Both Sivyer and Nugent have come to be recognized as being among the most outstanding electric steel foundries in the United States. Both have been active in the research and pioneering of new alloy steel castings to meet special conditions.

By combining, the managements expect to provide greater and more flexible facilities for the handling of their large alloy tonnages.

The new company will be unique in its industry. The production capacity of 1,400 tons per month, of small and variable section castings in high carbon and alloy steels, is said to be the largest of its kind. The two-plant set-up provides exceptional flexibility. Castings can be segregated by type to provide more routine foundry practice. Production can be stabilized. And the alloy business of both foundries can be centralized in one foundry under exceptionally close control.

The combined organizations will function under the name of The Sivyer Steel Casting Company, with the home office located in Milwaukee.

Notes from Gardner-Denver

Mr. E. F. Schaefer, vice-president in charge of sales, has just finished a trip through the northwest visiting the various branch offices. J. R. Farrell has been transferred from the St. Louis office to the Tulsa office as rock drill representative. E. H. Diamonds, formerly of the Andrews & George Co., agents in Japan, is associated with the San Francisco office as rock drill salesman.

The Gardner-Denver Company manufactures slush pumps, air compressors, high pressure drill steel forges, rock drills and drill sharpeners. Its plants are located in Denver, Colo., Quincy, Ill., and La Grange, Mo.

Soviet Russia Negotiating with Foote Bros. Gear

Negotiations for the purchase of 500 Bates tractors, costing in excess of $2,000,000, have been opened with Foote Brothers Gear & Machine Company by the Soviet government of Russia, W. C. Davis, president of Foote Brothers, stated recently. The Russian government is engaged in an active road building program and is buying equipment extensively in various markets for these improvements.

Foote Brothers Gear & Machine Company manufactures cut gears of every description for all types of machinery; transmission devices and road machinery in its Chicago and other plants.

Kring-Becker Will Handle Pennsylvania Pump Products

Announcement has been made of the appointment of the Kring-Becker Engineering Company as representatives in the Cincinnati and Louisville districts for the Pennsylvania Pump & Compressor Company. Their offices will be in the Mercantile Library Bldg., Cincinnati, O.

Looking It Over

B. M. Clark, Assistant Sales Manager; J. Wm. Heltzel, Assistant General Manager; J. N. Heltzel, President, and R. R. McBride, Chief Engineer, are shown looking over the Flex-plane machine.

In addition to the regular line of single-stage, double-suction centrifugal pumps with spherically seated bearings this company is now offering ball bearing type pumps, suitable for capacities up to 1,800 g.p.m. against heads up to 300 ft.

O. K. Clutch Opens Chicago Office

A Chicago office, located at 53 W. Jackson Blvd., and in charge of Mr. S. O. Nafziger, has been opened by O. K. Clutch & Machinery Company, whose headquarters are at Columbia, Pa.

Mr. Nafziger is well acquainted with hoisting machinery and compressors and will be well qualified to assist customers in selecting the right equipment for their requirements.

Representing American Tar Products Co.

Georgia and Florida representative for the American Tar Products Company, Mr. J. D. Brown, is located at 612 S. McDonough St., Decatur, Ga.

Mr. H. A. Van Orman, who represents this company in Mississippi, Louisiana and Alabama, has his headquarters at 814 Woodward Bldg., Birmingham, Ala.

Announcement has been made by the company that Mr. C. T. Metcalfe has recently been placed in the southwestern New York territory.

Personnel Changes

The Reading Chain & Block Corporation, whose main office and plant are at Reading, Pa., have added to their Cleveland sales and engineering staff under Mr. George R. Harrison, district manager.

The additions announced are Mr. W. C. Minier and Mr. F. C. Lorenz. Mr. Minier was formerly connected with the Shepherd Crane & Hoist Company, and Mr. Lorenz was for years connected with the Cleveland Electric Tramrail Company.

Announcement

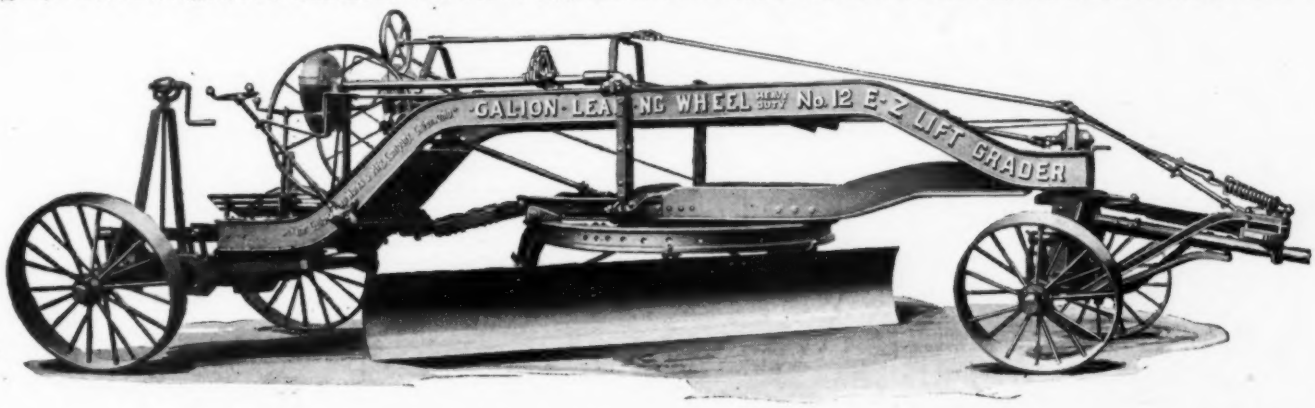
Announcement has been made that at a recent meeting of the directors of the Haynes Stellite Company, a unit of the Union Carbide & Carbon Corporation, Mr. E. E. LeVan was appointed general sales manager and Mr. J. H. Maguire was appointed works manager.

Other appointments announced were Mr. F. T. McCurdy, plant superintendent; Mr. J. R. Brown, Mr. F. L. Secord and Mr. Everett Page, assistants to superintendents; and Mr. L. H. Brown, research engineer.

Kalman Steel Company announces the election of Mr. Paul J. Kalman as chairman of the Board of Directors; Mr. George E. Routh, Jr., as president, and Mr. A. P. Clark as vice-president in charge of sales.

THE AUTOMATIC SKEW AXLE=

AN OUTSTANDING DEVELOPMENT-



IN GRADER CONSTRUCTION

Galion Distributors

W. A. Adams Tractor & Equip. Co., Raleigh, N. C.
R. S. Armstrong & Bro. Co., Atlanta, Ga.
O. B. Avery Co., St. Louis, Mo.
Badger Tractor & Equip. Co., Milwaukee, Wis.
W. D. Banker Road Machy. Co., Memphis, Tenn.
Banks-Miller Supply Co., Huntington, W. Va.
Borchert-Ingersoll, Inc., St. Paul, Minn.
Brown-Fraser & Co. Ltd., Vancouver, B. C.
Dukehart Machy. Co., Des Moines, Iowa
Easton Tractor Co., Cambridge, Mass.
Feenaughty Machy. Co., Portland, Ore.
Frankfort Equip. Co., Frankfort Ky.
Good Roads Machy. Co. Inc., New York, N. Y.
Hall Perry Machy. Co., Butte, Mont.
Herd Equip. Co., Oklahoma City, Okla.
Interstate Machy. & Supply Co., Omaha, Nebr.
Jeffrey Mfg. Co. Ltd., Montreal, Que.
Jenison Machy. Co., San Francisco, Cal.
C. H. Jones Co., Salt Lake City, Utah.
Lewis-Patten Co., San Antonio, Texas
Lewis Tractor & Machinery Co., Fargo, N. D.
Marsh Equip. Co., Colby, Kan.
Miller & Requarth, Springfield, Ill.
Morrow Auto Co., Albuquerque, New Mexico
H. W. Moore Equip. Co., Denver, Colo.
Morrisey Easton Tractor Co., Vicksburg, Miss.
Murphy & Murphy, Little Rock, Ark.
C. T. Patterson Co. Inc., New Orleans, La.
G. C. Phillips Tractor Co. Inc., Birmingham, Ala.
Power Equip. & Service Co., New Haven, Conn.
F. Ronstadt Co., Tucson, Ariz.
Salina Tractor & Thresher Co., Salina, Kan.
Bert Smith, Enid, Okla.
Smith-Booth-Usher Co., Los Angeles, Cal.
Standard Road Equip. Co., Rockford, Ill
W. H. Stoutenburg, Penn Yan, N. Y.
Tennessee Tractor Co., Nashville, Tenn.
F. E. Vaughn, LaCrosse, Kan.
Virginia Road Machy. Co., Richmond, Va.
Welch Good Roads Supply Co., Welch, W. Va.

To hold the loaded mouldboard against heavy work has ever been one of the biggest problems in grader construction. By combining the leaning wheel with the automatic skew axle Galion Adjustable Leaning Wheel Graders have an ability to hold to heavy work never before attained in a drawn grader.

EASY TO OPERATE

Adjustment is made by a double machine-cut worm screw operated by crank from the platform. Screw locks the adjustment automatically in any position.

DURABILITY AND STRENGTH

Nothing complicated about construction . . . . nothing to get out of order. Operating mechanism is ON THE FRAME, supported and protected by heavy frame cross members, not on the rear axle.

LOAD AND DRAFT CENTERED

Weight and draft on rear axle are always borne at two fixed points instead of being shifted to one side or the other to place undue strain on one wheel and one side of the axle.

Write for catalog completely describing Galion Graders and other road machinery.

The Galion Iron Works & Mfg. Co.

Galion - - - - - - - - - - Ohio

ROADS AND STREETS

H. P. Gillette Editor

Vol. LXX APRIL, 1930 No. 4

TABLE OF CONTENTS

Is the Toll Road a Solution 129

The Oil Mix Method in Missouri 132

Simplification of Sizes of Aggregate 133

Road Work in Victoria, Australia 135

Bituminous Retread in Missouri 137

Traffic Bound Macadam in Kentucky 141

Structures for Elimination of Grade Crossings 142

Routing Through Traffic in Cities 148

County Highway Traffic Control and Regulation 149

Traffic Separation at Grade Crossings 152

Light Surfaced Roads in Kansas 153

Gravel Road Maintenance in Nebraska 155

Improvements in Asphalt Paving Plant Equipment and Methods 158

Letters to the Editor 160

Editorials:

A Cure for Our Worst Economic Disease 161

Does "Space" Offer Resistance 161

Book Reviews 163

New Equipment and Materials in Highway Field 164

Distributor News 92

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